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Electricity Supply in the United States.

THANKS to the public spirit of the American Chamber of Commerce in London, last week an interesting address was given by Mr. Samuel Insull on the progress of electricity supply in the United States. He is the acknowledged leader of that public service in America; he is proud of his English birth—and we are proud of him. His views on the subject of electricity supply command attention, and a report of his address will be found elsewhere in this issue.

Those who have read the Weir Committee's Report are aware that Mr. Insull was consulted by that Committee, and in some cases his remarks are quoted verbatim; that his judgment is correct, as applied to American conditions, is attested by the unqualified success of the great undertakings under his control, and the extraordinary development of electricity supply in the 10,000 square miles served by them. As he remarked in the course of his address, the output of electricity in that area is only 10 per cent. less than the whole amount generated in this country, though the population of the area is only one-tenth as great; and the capital invested in generating plant is only half as much, the load factor being over 48 per cent., or about double the average obtaining here.

Mr. Insull, therefore, in dealing with electricity supply in the United States, knows what he is talking about; and when he turns to electricity supply in Great Britain, his sole purpose is to place his great experience at our disposal and thereby to promote the welfare of his Mother country. Knowing his ability and sincerity, we are reluctant to differ from his conclusions, but, so far as they relate to this country and only so far, we must do so to some extent, for reasons which he himself indicated—namely, that the conditions in the two countries are essentially different, so that what suits one would not necessarily suit the other. The methods of control, says Mr. Insull, are different; the United States is a young country; there, less respect is shown for vested interests—and, we may add, fewer interests have grown up; drastic regulations are laid down, which the British would dislike; the industry is almost wholly in the hands of companies, which, unlike our municipalities, can and do amalgamate freely; and the

United States, ever since the outbreak of the world war, has enjoyed unexampled prosperity with only a temporary lull, so that its inhabitants have had ample means to adopt electrical methods.

Turning from these sociological features to the physiography of the subject, we find that Mr. Insull cites three great areas in which interconnection (with few interruptions) has been fully carried out. Why? Because, in every case, water-power is available in some part of the area, and the only means by which it can be utilised is by transmission in the form of electricity. It is obvious that water-power is ideally adapted for carrying the long-hour loads, whilst steam power is eminently suitable for carrying peak loads; hence the well-known plan, which has been carried out in many other countries and is by no means peculiar to the United States, being plain common sense, of operating steam and water-power installations in conjunction with one another, by means of interconnecting mains. The case of California, which has been cited as possessing a "grid," is particularly irrelevant, for there we find abundant water-power in the mountains and not much coal available; hence there has been developed a colossal system of hydro-electric stations in the remote highlands, from which a continual stream of electrical energy flows, always in the same direction, down to the plains to feed the great cities. We can and do admire this wonderful development, but it has no bearing at all upon our case.

Let us look at home. Here we have coal-fields adjacent to every industrial district, for the obvious reason that the latter grew up near the former. The load curves are very similar, the generating plant is all of the same type, depending almost wholly on fuel, and there is no economic reason whatever for transmitting electrical energy across country—any slight gain due to increased diversity factor or improved load factor, highly hypothetical at best, would be swamped by the capital charges and the energy loss on a long transmission line. Moreover, the cost of generation is a minor factor in the total cost of supply. The only sound technical reason for coupling widely-separated power stations here is that of increasing the reliability of supply, but in view of the fact that that object can be more cheaply attained by installing additional plant, this argument fails to satisfy commercial requirements. As for the provision of supply to the areas between the power stations from the high-pressure interconnecting cables, when every tapping costs many thousands of pounds, this argument is futile in the extreme. Distributing systems at lower pressures must necessarily be run on appropriate routes, and this can be done just as well in the absence of the e.h.p. links. The North-East Coast is a case in point, where also the benefits of power supply from waste-heat sources are secured. All the realisable objects of the "grid" system in this country can be attained without converting the country into one huge "district."

As regards the question of "massing" generating plant, this is a natural consequence of a large demand; it may also be argued that a large demand is the consequence of massing generating plant, but this is not so certain. Generating sets of 60,000 kW are installed in the United States, others of 75,000 and 80,000 kW are on order, and we learn, with some astonishment, from Mr. Insull that a single set of 200,000 kW is under contemplation for a new station which is now being commenced. This set will consist of one h.p. and two l.p. turbines coupled to generators, and when any one machine breaks down, the other two will be capable of carrying upwards of half the rated load, at reduced efficiency. At present we have no station of anything like 200,000 kW, and no use for any generating set above 50,000 kW capacity; we doubt, indeed, whether it is desirable to install sets of greater capacity, for various reasons. The size of generating sets is only one of many factors in the economy problem, and bears no comparison in importance with the load factor. That is really the crux of the whole matter.

Electricity Supply Data.

In our "Correspondence" columns to-day, Mr. Hugh Quigley calls in question the accuracy of the data given in our leading article of April 16th. Whilst the *Electrical World* presumably would not lay claim either to infallibility or even to "sufficient infallibility," whatever that may mean, our contemporary makes a special feature of statistical returns and analyses, and unlike the Weir Committee, draws a clear distinction between units generated and units consumed. On page 7 of its issue for January 2nd, 1926, in tabulating the figures which we used in our leader, it states in a footnote that the data given for "Total Energy Generated" for the years 1920-1925 are "as collected by U.S. Geological Survey," the authority on which our correspondent relies. We have now consulted the annual report of the Geological Survey last issued under date June, 1925, and find that the energy generated during the calendar year 1924 by public utility undertakings is there given as 59,014 million kWh, as compared with the figure of 54,413 million attributed to the same authority by the *Electrical World*, showing the discrepancy to which Mr. Quigley draws attention; the difference is due to the fact that the aggregate figures given by the Survey (which are also tabulated on p. 10 of the same issue of the *Electrical World*) are not confined to central-station output, but include energy generated by electric railway and certain other plants that contribute to the public supply. On the other hand, the American figure that we used includes 6,200 million kWh for railways supplied from central stations, whilst most of the British railway consumption is excluded from the Electricity Commission's figure. Nevertheless, if we take the original figure of the Survey for 1924 we find that the units generated per head were 520, and the units consumed (at 81 per cent.) would be only 420. Hence our suggestion that the computer of the figures for the Weir Committee "made the serious mistake of basing it upon the *energy generated*, and comparing the result with the British figure for *energy consumed*," stands unrefuted. We may add that in a comparative survey of the world's output in the issue of the *Electrical World* for January 9th, p. 99, the energy generated *per capita* in the United States in 1924 is given as 484 kWh.

The Fuel Consumption Returns of the Electricity Commission to which our correspondent turns for "the only true comparison" are not relevant to the matter. Throughout the various discussions on this subject the comparison has purported to be made not between the quantities of electrical energy generated, but between the respective *consumptions* recorded, and in every case we have accepted the figures for British consumption given on the authority of the Electricity Commissioners themselves.

Mr. Quigley challenges other figures given by the *Electrical World*, which states that it carried out a "nation-wide survey" at the beginning of 1925, covering "every industrial plant of the United States using electrical energy," and received valuable co-operation from the Manufacturing Division of the U.S. Census Bureau, besides using official data. We must refer him to our contemporary for satisfaction on the points he raises. We stated the source of the data, and gave them for what they were worth. We believe that they are reliable. There are no such data available in this country. With regard to his suggestion that our comparisons were "very much in the nature of special pleading in favour of this country," if he means that we distorted facts for that purpose, we deny it with the utmost emphasis permissible in print; if he means that we are trying to obtain justice for our country, we accept the compliment with pleasure. It is high time that someone had a good word to say for the old country.

Stage Lighting.

It is now about seven years since Mr. J. B. Fagan read his paper on "The Art of Stage Lighting" before the Illuminating Engineering Society, treating the matter from the standpoint of the actor and producer of plays. One of the main points on which he then insisted was the advisability of diffusing the light and obtaining soft shadows by methods equivalent to the use of an "artificial sky." Since that date there has been substantial progress, and stage-lighting apparatus has been much improved. The paper read before the Society by Mr. H. Lester Groom, on March 30th, contained an interesting review of such developments. Amongst these an important place should be assigned to the "cyclorama," enabling panoramic and special colour effects to be obtained, and realistic atmospheric phenomena imitated. In some cases this has made possible radical departures in methods of presentation. Mr. L. G. Applebee also contributel some striking demonstrations, including the projection of a realistic image of the moving waves of the sea. Modern electric lighting is equal to almost any task the producer may set. What is chiefly needed is a recognition on the part of producers and scenic artists of what light can do, and a realisation that expenditure on apparatus for producing novel and striking light effects is well repaid—in short, a little more imagination and "vision." The Illuminating Engineering Society has done good service in providing this opportunity of drawing attention to the possibilities of stage-lighting, and the facilities for demonstrations available at the E.L.M.A. Lighting Service Bureau, where this meeting was held, proved very useful.

The Electricity (Supply) Bill.

The communication which we have received from Mr. R. A. Chattock, president of the Institution of Electrical Engineers, and which is printed on pp. 719 and 720 of this issue, deserves the careful study of everyone interested in the future of electricity supply in this country; it is closely in harmony with the views which we have put forward from time to time, and represents also the opinions of many engineers with whom we have discussed the subject.

It will be remembered that the Council of the Institution recently entered a grave protest against certain provisions of the Bill, as being based upon imperfect knowledge of the facts and likely to prove detrimental to the national interest (Elec. Rev., p. 527). The matter cannot be left there. If the Government does not institute the proposed inquiry into the fundamental questions on which the Bill is based—and in our opinion it never will do so—it will be the plain duty of the Council to call together a meeting of those interested in electricity supply, who up to the present have had no opportunity of publicly stating their views.

The Kelvin Lecture.

That the Kelvin lecture, in memory of the greatest man of science that has lived since Newton, should be delivered by Sir J. J. Thomson, President of the Royal Society, in the theatre of the Institution of Electrical Engineers, and should deal with "The Mechanics of the Electric Field," was surely a most happy combination of circumstances; for the Master of Trinity, described by Sir Oliver Lodge as also Master of Physics, has done more, probably, than any other physicist towards solving the problems presented by his difficult subject. Certainly, if we add to his labours the achievements of his pupils and colleagues, there can be no question that the Cavendish Laboratory, over which he presided for 34 years, has led the world in the attack upon the constitution of the atom, and has gone farthest towards revealing its secrets.

Sir Joseph had no difficulty in showing that electric force might reasonably be regarded as possibly intermittent in its action, taking the pressure of a gas as an analogy, and thus he proposed to reconcile the phenomena which can only be explained on the quantum theory with those which come within the scope of ordinary dynamics. Light, in particular, and X-rays in some respects are in conformity with the theory of propagation by wave motion and in others with the corpuscular theory which Newton preferred; the hypothesis outlined by Sir Joseph combines the two theories and provides an explanation both for interference effects and for photo-electric phenomena. For this purpose the electron must possess a structure, which he visualised as an atmosphere of particles surrounding the electron, possessing a definite period of vibration, and capable of emitting radiation. Much of the lecture was devoted to a mathematical discussion of the mechanism required by this constitution, conducted in that inimitable style which gives a peculiar charm to Sir Joseph's lectures.

The Institution is to be congratulated on receiving so lucid an exposition of the new theory from its distinguished author.

If the Cap Fits——.

We have a good deal of sympathy to spare for the young man who is anxious to "get a move on," but cannot do so because of the restraining influence of those who, above him in authority, are fearful lest his enterprise may be unconventional, may be off the beaten track over which the old cart has travelled so long and so safely, may offend somebody's susceptibilities, or may bring undesirable aggrandisement to the "young upstart." Of course, not all the new ideas of impulsive youth are to be swallowed at one gulp; it does not require hoary-headed experience to recognise that, even the initiator knows it—in most cases. But in times when change is so rapid, and especially in an industry which is always moving and presenting new possibilities, new opportunities, and creating a new atmosphere, it were well for all of us, whatever our age or experience, to be susceptible to the originality, ingenuity, and suggestiveness of others and not to get into the habit of closing our armour tight as though desiring it to be proof against the fiery darts of the wicked. Experience is priceless in its value, but where the possession of it is accompanied, as it sometimes is, by too profound a regard for conventionality and red-tape procedure, enterprise can be easily stifled, the spirit of youth broken, and out-of-date methods proceed along the inevitable pathway to loss and defeat. If we were to give any direct application to these moralisings we might leave untouched some who might otherwise profit by them, for though one comes across instances of those whose schemes have been brought to naught by prejudice rather than on de-merit, and though we could quote chapter and verse and names for such happenings in electrical trade, manufacturing and particularly in electricity supply—there is the possibility that specific cases might prevent the reader exercising those powers of introspection which are so useful a means of helping him to steer his own course amid the rocks wisely. New brooms in sweeping clean may make an insufferable smother of dust; a vacuum cleaner would do the job better, of course, but if a new broom be bought the user must be allowed a reasonable amount of latitude in its manipulation. We do not seriously object so long as the cobwebs gathered around the wheels of electricity supply enterprise are cleared away, whether it be a broom or a vacuum sweeper that accomplishes it, but we do know that some electrical undertakings would please their consumers better and profit the electrical industry more, if they would show a greater measure of adaptability than they do to the present age. Are there not company directors who are fearful when their staffs make new proposals, and municipal committeemen and councillors who find it easy to defer the adoption of advanced methods which their chief engineer and his staff are restlessly eager to employ? Having said so much, we leave it to all of our readers to wear the cap if it fits them—they can easily tell!

Electrical Developments at Ilford.

The A.C. Extensions to the Distribution System.

As we mentioned in our issue of April 16th, an official visit was made on April 8th to the converting sub-stations and one of the transformer kiosks of the Ilford Urban District Council Electricity Department, when the extensions to the distributing system were inaugurated by the Revd. Herbert Dunnico, M.P., J.P., chairman of the Council.

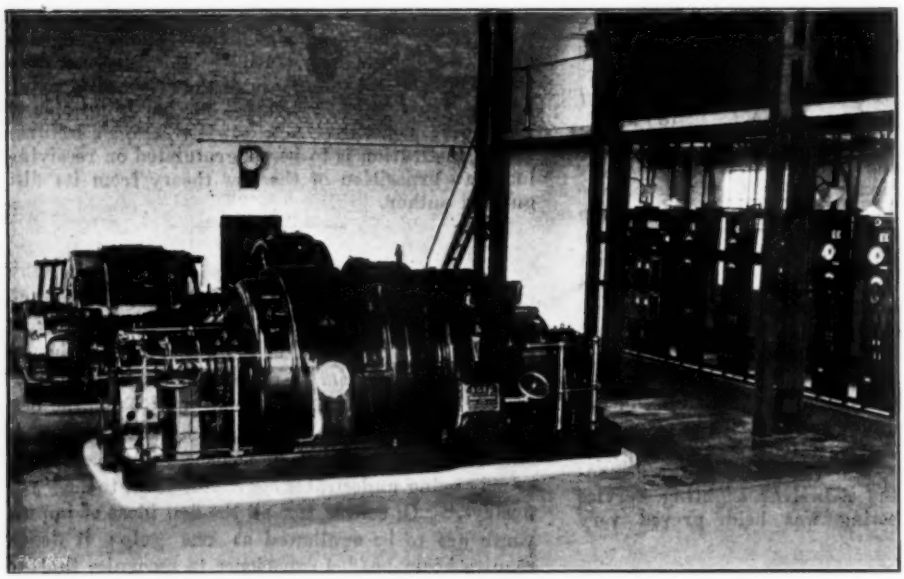


Fig. 1.—Uphall Road Sub-station.

The electricity supply in Ilford was commenced in 1901, l.p., d.c. systems for both generation and distribution being adopted. After the war it was found necessary to reorganise the systems, and two 3-phase, 6,600-V turbo-alternators were installed at the Ley Street generating station in 1920 and 1921; the sub-stations referred to have been installed at different times since then to make the necessary conversion of the a.c. energy for use on the d.c. system. In 1920 the Council was refused permission by the Electricity Commissioners to further extend the generating plant, and it became necessary to take a bulk supply of energy from an undertaking outside the district; hence in 1924 an agreement was reached between the West Ham, East Ham and Ilford authorities to an arrangement for West Ham to supply in bulk to the other undertakings interested. The necessary e.h.p. trunk transmission lines were laid between the West Ham and East Ham stations in 1922, and in 1924 they were extended from the East Ham station, *via* Barking, to the receiving sub-station of the Ilford undertaking adjoining Uphall Road, from where cables were laid to the Ley Street works.

The Uphall Road "sub" was erected in early 1924 primarily for the purpose of affording an increased supply of energy to consumers in the vicinity, and also as a receiving and metering point for the bulk supply from West Ham. The sub-station is at present equipped with two 1,000-kW La Cour converters, and arrangements are made for the installation of a third set, which is expected to be in operation by October next. The e.h.p. switchgear, which was installed by the General Electric Co., Ltd., is of the mechanically-operated remote-control type, the actual switch equipment being installed in a gallery built over the control board. A separate panel is installed on this board for the bulk-supply metering, this being equipped with two sets of meters and indicators by the Aron Meter Co., and duplicate bus-bars are provided, by means of which it is possible to connect either of the mains from West Ham to either of the link cables to the Ilford generating station.

The Gants Hill sub-station, which is situated at the junction of Cranbrook Road and Eastern Avenue, is of the fully-automatic type, the equipment being supplied and installed by the Metropolitan-Vickers Electrical Co., Ltd. It was first put into commission in December last. It is designed to come into operation when the pressure of the system falls below a given value, the reverse action taking place when the load on the system falls off. As already mentioned, a feature of the sub-

Fig. 2.—100-kVA. Transformer Kiosk.

station is that the converting plant is not disconnected from the system until 20 minutes after the load falls below the set value. The necessary conversion at Gants Hill is effected by means of a 500-kW rotary converter fed from a 550-kVA transformer. A 4-panel control board accommodates the necessary relays and switchgear for controlling the a.c. side of the machine, the d.c. equipment being installed on a separate panel of an open-type distribution board. Four Metro-Vick K-type e.h.p. oil switches are installed, two for the control of the incoming and outgoing feeders and two for the control of the supply and operating transformers. It is interesting to note that a contract has been placed with the makers for a duplicate equipment to be installed in the district, which is expected to be in operation by October of this year.

The sub-station at Grove Road was first equipped in 1916 to give an a.c. supply to the adjoining works of the Fuller Electric & Manufacturing Co., Ltd. Since that time the station has been extended, and is now equipped with three G.E.C. rotary converters, 250, 280, and 500 kW, and the necessary transformers, which were manufactured by the Brush Electrical Manufacturing Co., Ltd., A 6-panel, steel-cubicle, e.h.p. switchboard and a 7-panel, open-type, d.c. board were installed by the General Electric Co., Ltd.

The "sub" at Goodmayes, which is now equipped with two 500-kW Crompton converters, two 550-kVA British Electric transformers, a 4-panel steel-cubicle e.h.p. board, and an open-type d.c. board, both of Crompton manufacture, was first used in 1915 as a battery sub-station. The sub-station forms the back portion of a large building, the front part of which is utilised as a showroom. This is served by two large display windows on either side of the central entrance. The showroom proper occupies the full frontage of the building, and on one side are accommodated cubicles for lighting demonstration purposes.

During last year the e.h.p. mains were extended to Barkingside, and a transformer kiosk, fig. 2, was erected at the corner of Fencepiece Road and Tomswood Hill for an a.c. supply to the Tomswood Hill housing estate and district. The kiosk was supplied by Messrs. Callender's Cable & Construction Co., Ltd. It is a steel structure, about 8 ft. square, and houses a 100-kVA Fuller transformer, three e.h.p. switches controlling the transformer and incoming and outgoing feeders, and four l.p. feeders. A similar kiosk has been supplied by the Foster Electrical and Manufacturing Co., Ltd., and erected near the Hainault station for supplying the district.

The Resistance and Heating of Plunger-Type Lampholders.

By L. G. H. SARSFIELD, B.Sc., A.M.I.E.E.

Résumé.

In a previous paper* by the author on the above subject, the possibilities of the adoption of plunger-type lampholders for the connecting of domestic electrical apparatus to the supply were discussed. Graphs were given for the voltage drops across various parts of these holders, and the causes of heating were observed. The values of spring resistance were given, and the behaviour of steel and bronze springs was compared. The results of ageing were seen, and curves were given showing the temperature of the air inside lampholders. Heat runs to destruction were described and a suggestion was put forward for increasing the current-carrying capacity of this type of link between apparatus and power.

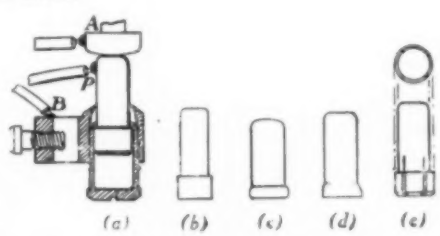
The manufacturer at whose instigation the above work was undertaken subsequently raised the question of the current-carrying capacity of the contact between the plunger tops and the adaptor, and the experiments here described were designed with this in view and also to obtain the actual temperatures of the other component parts of ordinary lampholders. Messrs. Tucker's lampholders were again employed throughout the following investigations.

Heat Runs with Ordinary "Telac" Lampholders.

Batten-type holders were set up in free air on a table and current was led to and from them at the sleeve blocks "B" (fig. 1 (*a*)).

The source of supply was a battery of accumulators. The load was connected to each holder by means of an ordinary adaptor, and consisted of two variable resistances in series. One of these was of the carbon-plate type and accommodated the heavy currents employed during the latter part of each of these tests.

Fine wire thermo-couples (copper Eureka) were soldered to both poles of the holders and adaptors at the sleeve blocks "B," plungers "P," and adaptors "A" in the positions shown in fig. 1 (*a*). The spring has been omitted in order to simplify the drawing. The point at which a couple was attached to a plunger was near to its top, so as to avoid fouling the sleeve block when compressed downwards, as it is when in use. By this means the temperatures of the different parts of the units were obtained. There was no difficulty in securing temperatures at currents as low as three amperes, although in the previous series of heating tests mentioned in the first paragraph, five-ampere temperature values were the lowest obtainable. This was due to the fact that the one thermo-couple then used was placed midway between the two plungers and not attached to the active metal, so that there was a difference of temperature between the latter and the couple itself.



a, Mode of attachment of thermo-couples; *b*, *c*, *d*, Types of plunger now in use; *e*, Split plunger.

Fig. 1.—Details of Apparatus.

The thermo-couple wires were led from the sleeve blocks and plungers through the tubular portion of the holder by way of holes suitably drilled therein. The wires were insulated with varnished cambric tubing of outside diameter about 1/10th in. The holes made for the plunger couples were slotted vertically, so as to prevent any restraint upon the plungers due to the couple wires. All the thermo-couples were alike, and were calibrated with the micro-ammeter used throughout the whole series of observations.

Beginning at 3 amperes, current was passed through each holder and the temperature registered by the micro-ammeter deflection. Conditions were considered to be steady for each value of current when there was no

* ELECTRICAL REVIEW, February 13th, 1925.

readable alteration of the instrument needle after five minutes. Observations were made at 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30 amperes, except, of course, when a holder would not permit the higher of these values.

Fig. 2 gives the heating curves for new holders with standard bronze springs, each line being the mean of four sets of readings, *i.e.*, on both poles of two separate units individually tested. Fig. 3 gives similar curves for one holder about 15 years old, but provided with slightly tarnished new bronze springs in place of the steel ones originally found in it.

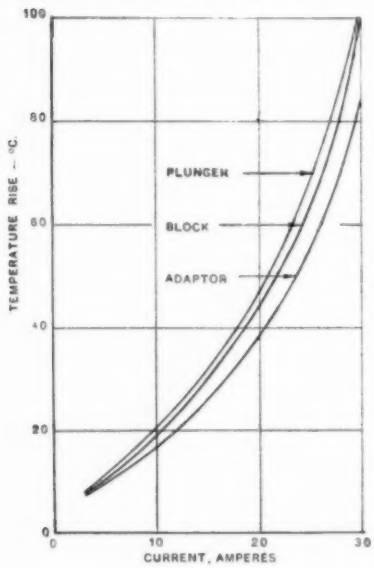


Fig. 2.
Lampholders fitted with new ordinary plungers, new blocks, and new bronze springs.

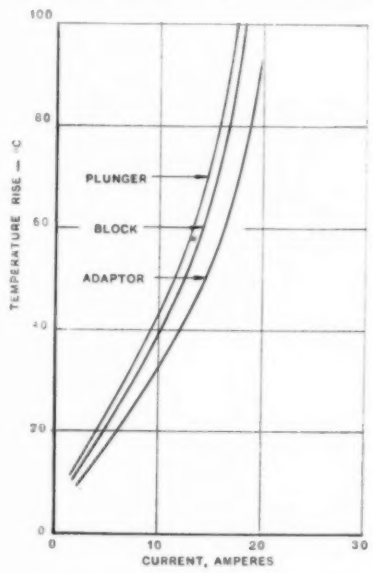


Fig. 3.
Old lampholder fitted with slightly tarnished bronze springs.

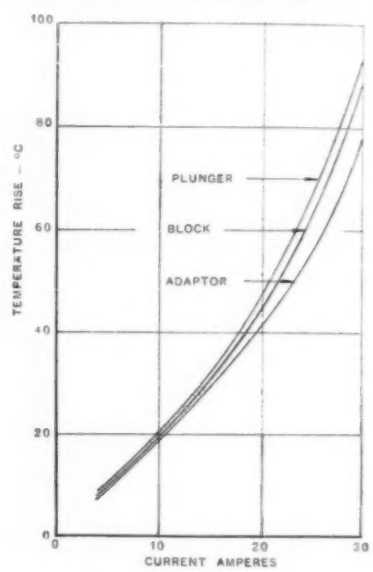


Fig. 4.
Lampholders fitted with new split-plungers, new blocks, and new bronze springs.

Curves showing the Temperature Rise with Varying Current Strength.

The difference between the two sets of curves is very marked, and whereas, after obtaining the 30-ampere readings with the new units, a current of 40 amperes was passed through one of them for five minutes before collapse of the spring (indicated by unsteadiness of micro-ammeter reading and "clicking" noises), the springs of the old unit were collapsing before 20 amperes could be reached. Judging from the adaptor temperatures in figs. 2 and 3, the coolest contact of the three in each case is that between the adaptor and the plunger, and this suggests that it is not this part of the holder which, up to the present time, forms its current capacity limiting feature. The hottest part in every case, however, is the plunger.

The previous series of experiments showed the contact resistance between the plunger and the sleeve block to be greater than that between the plunger and the adaptor for old steel-sprung units, and it was with a view to improving the former contact that bronze springs were adopted. The results were encouraging.

Split-End Plunger.

A new method was suggested, however, in the author's previous article* for improving the contact between the plunger and the sleeve block. It was proposed that the flanged open end of each plunger should be a cylinder which would be a fair fit in its sleeve block, so that when compressed or released the plunger would always be in contact with the inside of the block.

*Electrical Review, February 13th, 1925.

Experiments were carried out by Messrs. J. H. Tucker and Co. as to the best method of obtaining this effect, with the result that the standard cylindrical ends of their plungers were saw-cut through along two diameters at right angles (fig. 1 (*e*)). This arrangement permits the plunger end to be sprung slightly outwards, and a positive contact with the inside of the screwed cylinder which enters the bottom of the sleeve block is thus obtained. The fit is not such as to introduce undue friction, and, moreover, the rubbing surfaces tend to keep bright due to the movement of one with respect to the other whenever an adaptor or lamp is inserted in, or withdrawn from, a holder. With this scheme the spring is no longer the main current-carrying medium, and therefore steel springs may be used with confidence. In fact, they would be better than bronze ones, on account of their superior mechanical properties. A test of a holder fitted with split-end plungers and steel springs is described later.

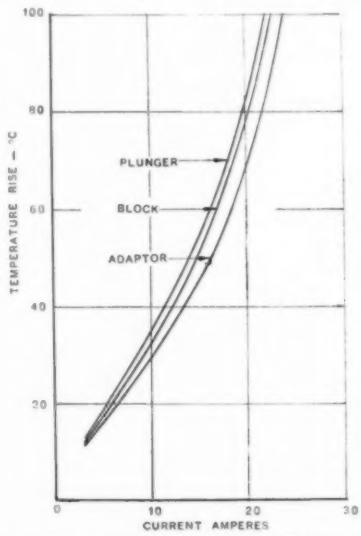


Fig. 5.—Lampholders fitted with artificially-aged ordinary plungers, blocks, and bronze springs.

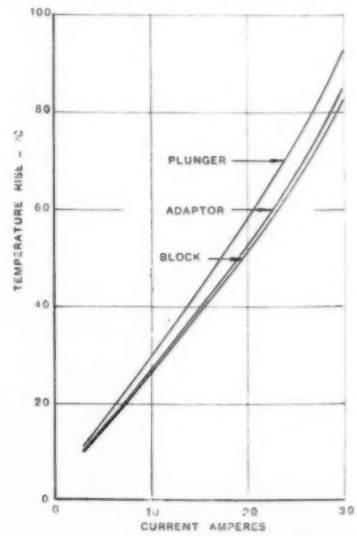


Fig. 6.—Lampholders fitted with artificially-aged split plungers, blocks, and bronze springs.

Curves of Temperature Rise with Current.

Resistance of Split-End Plunger.

The values of voltage drop between plunger and sleeve block for split-end plungers were compared with the values for ordinary plungers. Six plungers of each type were fitted with new bronze springs in sleeve blocks.

Without mounting these in holders, current leads were soldered to the plunger tops and to the blocks, and thus the only movable contact in each unit was that whose resistance was required. A current of 3 amperes was passed through each unit, and by means of flexibles soldered one on to the plunger and one on to the block and connected to a milli-voltmeter, the voltage drop across each unit was measured.

Three voltage drop readings were taken for each unit—

(*a*) with the plunger fully extended under the influence of the spring;

(*b*) with the plunger pressed in as far as possible; and

(*c*) the maximum swing observed on the instrument during a number of rapidly applied compressions and releases.

The mean values are below, and they point to the improvement of contact due to the split-end plunger:—

	(*a*)	(*b*)	(*c*)	
Ordinary plunger ...	7.9	2.0	15.3	millivolts
Split-end plungers ...	2.3	1.5	3.3	,,

The "*c*" values of the "ambient" plunger are particularly significant, and testify to the regular travel of the plunger, in and out. This is a feature of importance, especially when the holder is subjected to mechanical shock, since (as mentioned in the previous article) the looseness of fit of the plunger in the sleeve block, common in many types of holder, may constitute the spring the only electrical connection between them. This is, of course, very undesirable.

Heat-runs with Split-End Plungers.

In order to compare the temperature rises of holders having split-end plungers with standard ones, units were arranged as described in paragraph 3. The heating curves for new units fitted with split-end plungers are plotted in fig. 4.

Each line is again the mean of four sets of readings. As would be expected, they are similar to those of new ordinary holders (fig. 2), but the latter have steeper slopes and higher temperatures beyond 20 amperes. Slight permanent compression of the springs was noticed after 30 amperes in each of the two holders tested, but one was subjected to further test and carried 40 amperes for five minutes, followed by 50 amperes for three minutes. This caused crippling of the springs, *i.e.*, permanent compression to about half the original length, but not entire collapse.

Two new holders, one with split-end plungers and the other with ordinary plungers, were then equipped with new steel springs and the current-temperature curves taken for each. The mean temperatures for the two poles of each unit at 30 amperes were as follows:—

	Adaptor.	Plunger.	Block.	
Ordinary plungers ...	76.3	92.5	84.3	deg. C.
Split-end plungers ...	57.1	65.9	59.5	,,

After the 30-ampere readings were taken, the ordinary type holder sustained 50 amperes for five minutes, with the result that one spring was slightly compressed and the other crippled, while the holder having split-end plungers sustained 50 amperes for five minutes and the springs were apparently unaffected.

It is, however, the performance of old holders which must be the test of serviceability, but as no old split-end plunger units were available, artificial ageing was resorted to. Two split-end plunger and two ordinary units, each fitted with new bronze springs, were dipped into a boiling liquid consisting of equal proportions of sodium hyposulphite and lead acetate. This gave them a light brownish-blue coloration on the outside which is similar to the appearance of really old parts. The insides of the ordinary type plungers and blocks remained practically new, while owing to the saw-cuts in the split-end type their inner surfaces were tarnished, though not to the same extent as their outsides.

These plungers were set up in holders for heat runs in exactly the same manner as those already described, and fig. 5 gives the mean temperature curves of the two poles for the ordinary type, while fig. 6 gives those for the split-end type.

The difference between the two sets of curves is easily seen, and it is definite over the whole range of the curves. For instance, the average temperature rise represented by the three curves for the holder fitted with split-end plungers at 5 amperes is 15.3 deg. C., whereas that for the ordinary type is 17.4 deg. C., which means that there is about 12 per cent. reduction of heating at this current rating. Since the slope of the curves for ordinary holders increases with current so much more rapidly than that of the curves for the split-end type, this percentage gradually grows, and at 20 amperes reaches about 28 per cent.

After the heating curve readings were taken on each of these artificially-aged units, higher currents were passed through them; the ordinary type withstood 40 amperes for four minutes and then smoking commenced, while the split-end plungers withstood 40 amperes for eight minutes, and subsequently 50 amperes for three minutes, without damage to the springs.

The appearance of the one really old ordinary unit whose temperature rise was measured (fig. 3) was similar to that of the artificially-aged units described above. This old unit collapsed at about 20 amperes. A holder was, however, put on test which had been fitted with split-end plungers artificially aged until they were almost black outside and dark brown inside, i.e., in a condition much worse than any really old units ever seen by the author. It gave a plunger temperature rise of 110 deg. C. at 20 amperes, and subsequently withstood 30 amperes for eight minutes. After such a severe test the springs were crippled.

All these experiments support the view that the split-end plunger is a good current-carrying proposition, and application is being made for a patent in respect thereof. The properties of this type, which render it able to carry large currents satisfactorily, must contribute to greater reliability at all ratings, and, furthermore, make the plunger practically independent of a current-carrying spring. Steel springs, as already mentioned, may thus be used—their electrical inferiority to bronze ones being of small account, while their mechanical superiority is valuable.

	Spring Steel.	Spring Bronze.	
Young's modulus ...	13,000 tons/sq. in.	5,000 tons/sq. in.	approx.
Annealing temp. ...	350°C	250°C	approx.

By employing split-end plunger lampholders, the need for wiring power plugs in order to use most domestic appliances is obviated, and it is suggested that the convenience of being able to connect up such apparatus to a lighting point is important and calculated to popularise the use of electrical gear in our homes. The increase in cost for split-end plungers in all the lighting points of a domestic installation would be negligible.

It is a pleasure to acknowledge the co-operation of the Governors of the Merchant Venturers' Technical College, Bristol, and Prof. D. Robertson, D.Sc., who provided facilities in their electrical engineering laboratories, and also the kindness of Messrs. J. H. Tucker and Co. in supplying the lampholder parts used in these experiments.

A New Fire-Damp Indicator.—At a recent meeting of the Austrian Natural Science Society, of Innsbruck, Herr Martienssen, of Kiel, read a paper in which he described a new electric safety lamp for the use of miners in places where firedamp explosions are feared. After many unsuccessful attempts, Martienssen claims to have succeeded in producing a firedamp-indicating electric lamp by using small semi-circular loops, made of a preparation of palladium, placed in a small glass bulb which is closed at its upper end by a porous stone. By means of a button switch, the current from a small accumulator carried in the base of the lamp is passed through the filament, which causes its extremities to assume a dark red colour, this serving as an indication that the apparatus is in proper working order. If there is methane in the air in the mine, the centre of the filament commences to become more or less incandescent, and if the methane percentage reaches 8 per cent. the filament will remain incandescent even when the current from the battery is switched off. In this way Martienssen considers that it is possible to estimate approximately the quantity of methane in the air in mines.

Electrical Progress in New Zealand.

Some Particulars of the Mangahao Hydro-Electric Scheme.

It will be recalled that the first of the three large water-power schemes adopted by the New Zealand Government in 1918 for the supply of electrical energy throughout the North Island was the one on the Mangahao River, the other two projects being those at the Waikaremoana Lake and the Arapuni Rapids (ELECTRICAL REVIEW, August 29th, 1924, p. 314). The Mangahao undertaking is situated close to a large potential load of some 12,000 kVA in the Wellington area, and the site is capable of developing 24,000 kVA. The Mangahao River is almost solely dependent on rainfall for its flow, and therefore its water volume varies considerably. The normal flow is about 150 cusecs, but it has been as low as 70 cusecs. The scheme provided initially for two main storage reservoirs, a third to be added at a later date. The larger reservoir is on the Mangahao River, the smaller one being on the River Tokomaru close to its junction with the Arapeti stream. The two reservoirs are connected by a large concrete-lined tunnel, 7 ft. in diameter and about a mile long, driven through the intervening range of hills. Another tunnel connects the second reservoir to a surge chamber above the power house, from where steel pipes convey the water to the station situated at the junction of the Mangaore and Mangatangi Creeks. The net water drop is 870 ft., and the total fall from the upper reservoir is 995 ft. Fig. 5 shows the general lay-out of the scheme. The construction of the Mangahao and Arapeti dams has proved to be a much more difficult matter than was at first expected, due primarily to the trouble in finding a suitable rock foundation for the base of the dams and to the frequent floods that have occurred since the construction was commenced. The preliminary surveys of the dam sites failed to reveal that both the Mangahao and Tokomaru Rivers had, at some distant period, changed their beds, and in the course of time had cut new beds parallel to the old ones. This discovery necessitated the construction of a cut-off wall from the end of the dam to the solid rock on the far side of the old channel as a seal to prevent water loss by seepage round the end of the dam. The Mangahao dam is 100 ft. high, 118 ft. long, and 95 ft. thick at its base. An automatic steel crest surmounting the structure maintains a constant water level in times of flood. As the water rises over the crest, the increased pressure causes the latter to fall, the distance being governed by a concrete counterweight. The Mangahao reservoir holds 525,000,000 gallons of water.

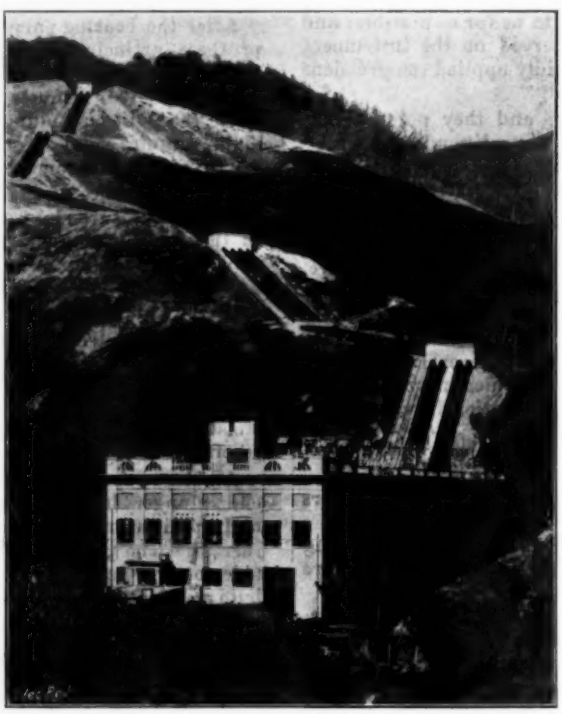


Fig. 1.—Mangahao Station and Pipe Line.

The Arapeti dam is 430 ft. long and of 66 ft. maximum width; and the reservoir has a capacity of 290,000,000 gallons.

The generating-station scheme provides for five main turbines of the Pelton type. Three of these

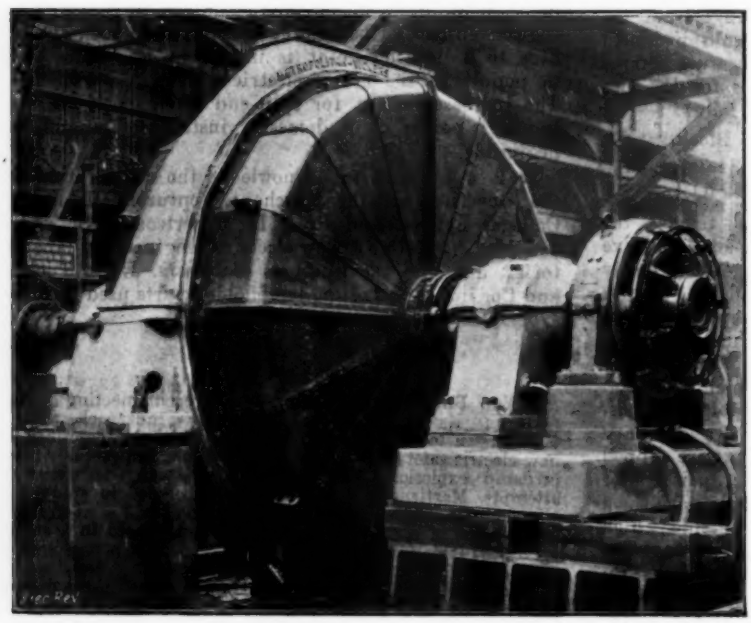


Fig. 2.—6,000-kVA Alternator.

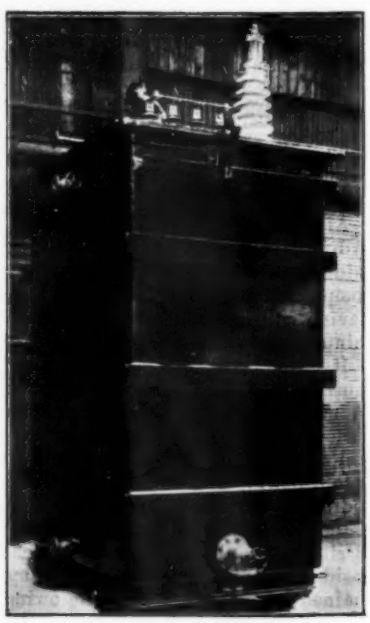


Fig. 3.—Single-phase Step-up Unit.

are designed for a maximum output of 8,000 h.p., and two for a 4,000-h.p. output, both sizes running at 375 r.p.m. under a head of 825 ft. The larger turbines have two jets each, and the smaller machines are provided

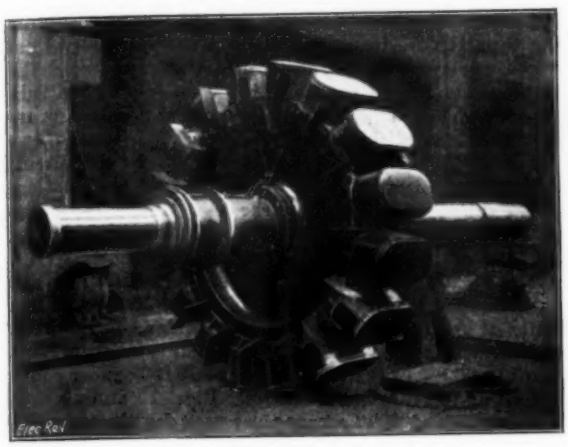


Fig. 4.—Rotor of 6,000-kVA Machine.

with only one jet. The machines are controlled by automatic oil-pressure governors which operate directly on deflectors and indirectly upon the needles. The deflectors cut into the jets and disperse them at times of sudden reduction of load. The needles feed forward slowly, controlled by dashpots, and gradually cut off the supply of water to the required extent. For increasing loads, both the deflectors and the needles are withdrawn simultaneously.

The larger generators are each of 6,000-kVA capacity, and the smaller ones 3,000 kVA. These machines generate 3-phase energy at 11,000 V, 50 periods; fig. 2 shows one of the larger sets, and fig. 4 its rotor. The alternators are excited from separate exciter units, driven either by water power or induction motors. The 3,000-kVA machines are also fitted with direct-coupled exciters. The turbines and alternators are housed in one large room running almost the full length of the building, and the transformer banks are situated in a separate room. Between these two departments are housed the switch and control rooms. The masonry cubicles containing the 11,000-V apparatus are situated on the main floor level. The control room is immediately above the cubicle room, and is so arranged that the switchboard operators have a clear view into the turbine house.

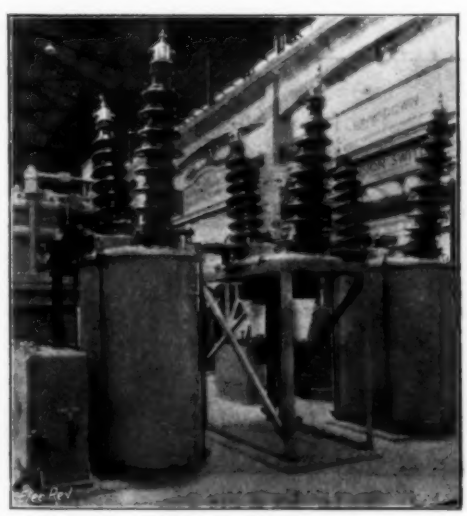


Fig. 6.—110-kV Oil Circuit Breakers.

The 110-kV switchgear is placed partly inside and partly outside the station, the transformer-controlling equipment inside and the feeder switchgear outside. The transmission lines are dead ended at special points on the building structure, jumper connections linking up to the apparatus on the roof. Fig. 7 shows one of the 110,000-V overhead horn-gap switches.

For the districts immediately around the station energy at the generating pressure is transmitted, but for the long-distance transmission, the pressure is raised to 110,000 V. The main transmission lines are fed through two banks of transformers, and it is interesting to recall that these were the first power trans-

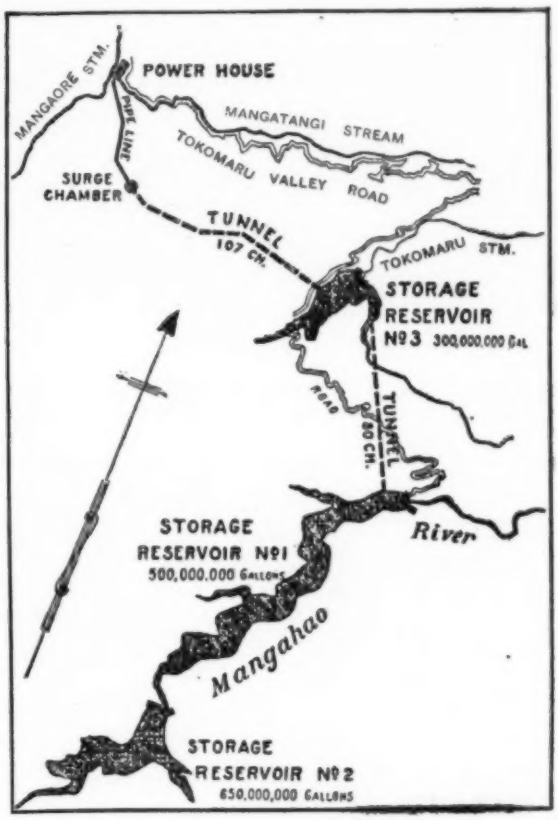


Fig. 5.—General Layout of Mangahao Scheme.

formers of this size to be manufactured in Great Britain for a 110,000-V transmission system. Each three-phase group is of 12,000-kVA capacity, and consists of three single-phase, 4,000-kVA transformers connected in delta on the l.p. and star on the h.p. sides. In addition, one single-phase unit forms a spare to the two groups. Single-phase units, fig. 3, were adopted to facilitate transport over the difficult roads leading to the site. Tappings are arranged on the l.p. windings for 10,750 and 10,500 V, and the full output may be obtained at all the tappings.

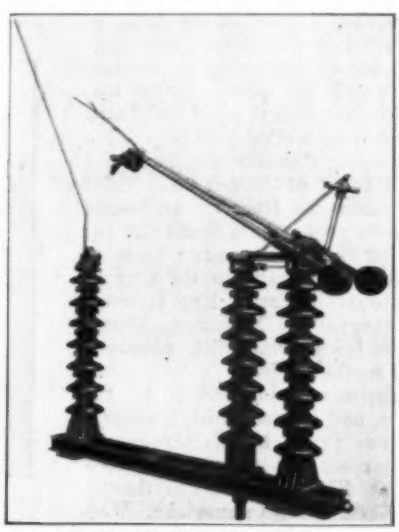


Fig. 7.—110-kV Overhead Switch.

The transformers are of the oil-immersed, forced-cooled, double-wound, core type, and their mechanical construction is such as to allow transport on their sides in the tanks; fig. 11 shows one of the transformers arranged for transport. The h.p. coils are wound

in sections of disk coils, of one turn per layer, thereby reducing the voltage stress between the turns to a minimum.

The main insulation is designed to avoid all danger of creepage along the surfaces, and the end turns of

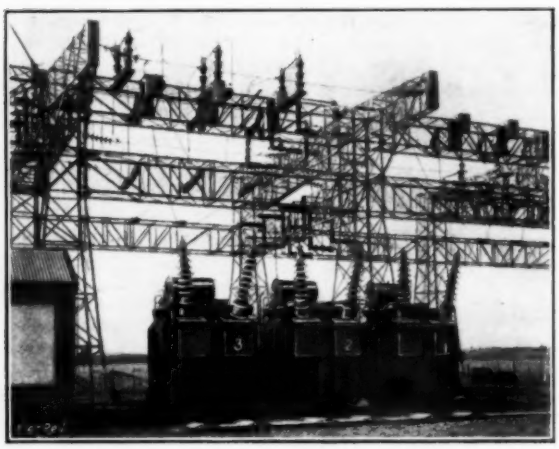


Fig. 8.—Bunnythorpe Sub-station.

both the h.p. and l.p. windings are specially insulated to withstand surge voltages and transient disturbances. The dielectric field is so controlled as to render the pressure gradients as uniform as possible, and the

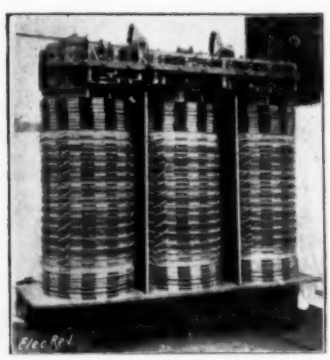


Fig. 9.—Interior of Step-down Transformer.

Fig. 10.—Three-phase Unit.

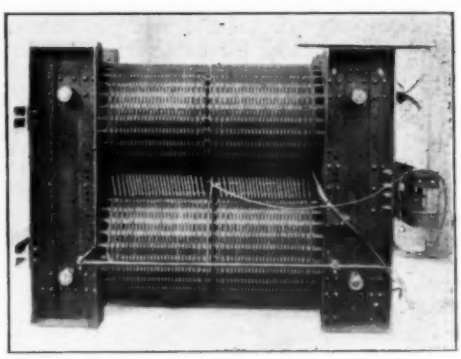


Fig. 11.—Step-up Transformer arranged for Transport.

windings are adequately braced to withstand mechanical shocks which may occur under working conditions, including those produced under short circuits. A spring clamp device is arranged between the coils, so that it takes up effectively any shrinkage which may occur in the coils. One set of oil-cooling apparatus, comprising cooler, centrifugal oil pump, motor and controlling gear, is provided for each three-phase group. The h.p. terminals are of the oil-filled porcelain type. The construction of these transformers was described fully in the ELECTRICAL REVIEW of October 20th, 1922.

Four high-pressure transmission lines are connected to the station; two of these go north to Bunnythorpe, some 25 miles away, whilst the other two run south to Khandallah, 63 miles, for the supply to the City of Wellington. A duplicate transmission line connects Khandallah with Bunnythorpe, *via* Masterton, Eketahuna, and a switching station at Woodville, whence a branch is also connected to Dannevirke.

The main-line transmission is undertaken by the Public Works Department, and the local distribution is carried out by the various power boards throughout the country. For this purpose sub-stations have been or are being established at Khandallah, Bunnythorpe, Wanganui, Masterton, Eketahuna, Dannevirke, Waipukurau, Napier, and Otaki. From these sub-stations and from the power station at Mangahao energy will be supplied at 11,000 volts to the power boards. The equipment of these sub-stations consists of the main transformers, switchgear, lightning arresters, and recording instruments.

The sub-station of Bunnythorpe, fig. 8, is of the outdoor type and supplies Palmerston North and the surrounding Marawatu district. The equipment consists of a 110,000/11,000-V, 3-phase, 4,500-kVA transformer bank, figs. 9 and 10, and oil circuit breakers, fig. 6, of 400-A normal-current capacity and 495,000-kVA rupturing capacity are being installed on the 110,000-V lines which connect with the switching station at Woodville to the east, and to the north with the Wanganui sub-station, whence a projected line will eventually link up with the Arapuni hydro-electric generating station, two hundred miles further north. Similar oil circuit breakers are installed at the Woodville switching station.

The sub-station at Dannevirke, figs. 13 and 14, is also of the outdoor type, equipped with two 1,500-kVA, three-phase, 110,000/11,000-V transformers.

The greater part of the main and local lines are run on hardwood poles, the former of Australian wood, the latter of Australian wood or New Zealand silver pine, the lines being carried on suspension-type insulators. The 110,000-V lines are composed of 19/13 copper cables spaced at 10 ft. between centres. Figs. 15 and 16 show the single- and double-type poles used for the transmission lines.

Between Khandallah and Packakariki, a distance of about 20 miles over country difficult to patrol, steel towers carrying double circuits are to be used instead of poles in order to reduce to a minimum the risk of line troubles on this section.

Fig. 1 shows the completed generating station and pipe line.

The popularity of the electricity supply has rendered it necessary to proceed with the construction of the third dam to provide a means for increasing the load. The construction of this dam involves the laying of

Fig. 12.—Site of New Dam.

some 3½ miles of road, and this is now completed, and work on the dam itself commenced. Fig. 12 shows the site of this dam. A Keystone drill is working overtime testing the geological formation at the dam site, and the bush surrounding the surveyed

district has been felled. Cottages for the use of the workmen are completed, and service buildings and a community cookhouse are in operating order. The first supplies of material for the dam are now being carried through, and excavation work on the dam site is well under way. The completion of the new dam will double

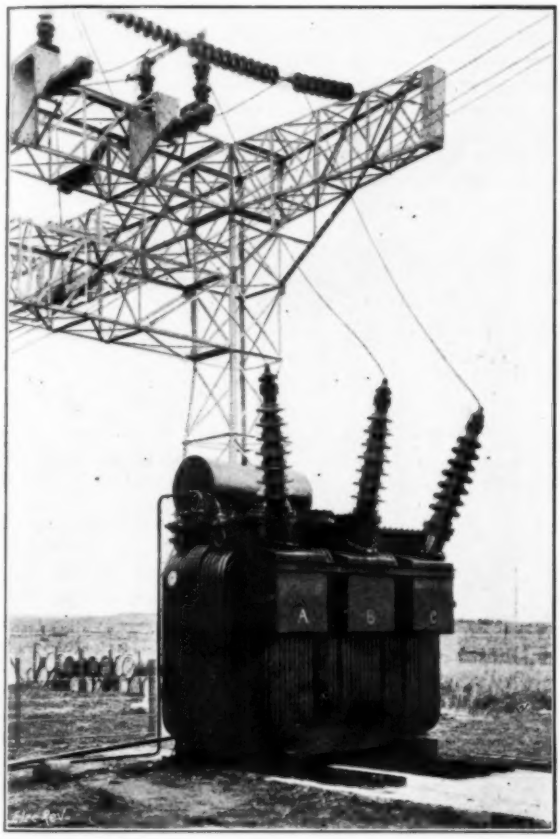


Fig. 13.—A Section of Dannevirke Sub-station.

the storage capacity of the present scheme, and make available, with some few extensions at the power house, an additional 12,000 kW, thus doubling the capacity of the station.

The transmission scheme from Mangahao is being enlarged almost daily, and the various sub-stations within its area are linking up practically every hamlet and isolated settlement within the effective radius. Already over 600 miles of transmission lines have been erected, and the total is steadily increasing.

In conclusion, we are indebted to Messrs. Ferranti, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.,

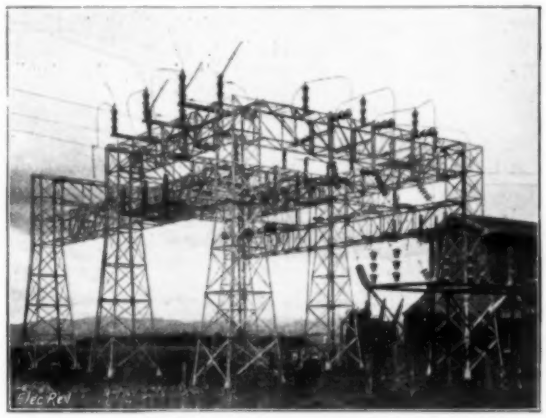


Fig. 14.—The Sub-station at Dannevirke.

for their assistance in the preparation of this article. Messrs. Ferranti supplied the step-up transformers, and

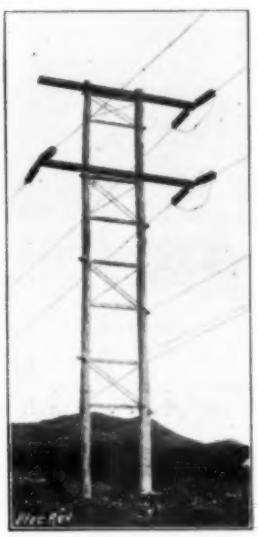


Fig. 15.—Double Pole.

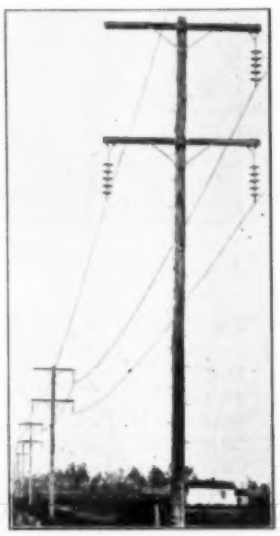


Fig. 16.—110,000-V Line.

Messrs. Metropolitan-Vickers supplied the alternators and the sub-station equipments.

The I.E.C. Meeting in America.—I.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

On Good Friday, April 2nd, the Cunard Liner *Andania* sailed from Southampton with the following British delegates who were attending the New York meeting of the International Electrotechnical Commission:—

Col. R. E. Crompton, C.B., R.E. (Hon. Sec., I.E.C.).

Sir Archibald Denny, Bart. (Chairman, B.E.S.A.).

Sir Richard Glazebrook, K.C.B. (Chairman, British National Committee).

Mr. C. P. Sparks (Vice-Chairman, British National Committee).

Mr. C. Le Maistre, C.B.E. (General Sec., I.E.C.).

Mr. Ll. B. Atkinson (Director, Cable Makers' Assn.).

Mr. S. C. Bartholomew (General Post Office).

Mr. E. G. Batt (General Electric Co., Ltd.).

Mr. W. S. Burge (English Electric Co., Ltd.).

Capt. P. Dunsheath (W. T. Henley's Telegraph Works Co., Ltd.).

Mr. A. R. Everest (British Thomson-Houston Co., Ltd.).

Mr. W. Lee (Silvertown Lubricants, Ltd.).

Mr. S. W. Melsom (Callender's Cable & Construction Co., Ltd.).

Dr. A. C. Michie (Electrical Research Association).

Mr. R. B. Mitchell (President, Incorporated Municipal Electrical Association).

Mr. W. S. Marshall (Shell-Mex, Ltd.).

Mr. A. P. Mossay (Electric Vehicle Committee of the U.K.).

Mr. J. S. Peck (Metropolitan-Vickers Electrical Co., Ltd.).

Mr. C. Rodgers (Secretary, British Electrical and Allied Manufacturers' Association).

Mr. T. Roles (City Electrical Engineer, Bradford).

Mr. P. F. Rowell (Secretary, Institution of Electrical Engineers).

Mr. F. Wallis (English Electric Co., Ltd.).

Lt.-Col. K. Edgcumbe (Everett, Edgcumbe & Co., Ltd.)

The British contingent, consisting of twenty-three members, was joined at Cherbourg by the representatives of twelve other countries, constituting in all upwards of ninety engineers, a veritable Electrical League of Nations.

Lt.-Col. K. Edgcumbe.

Col. R. E. Crompton.

A Fancy Dress Competition.

Mr. S. C. Bartholomew.

The various European countries represented, with the principal delegates attending are as follows:—

Austria: Herr Bretschneider (Vice-President, Austrian Standards Committee).

Belgium: M. E. Uytborck (Secretary, Belgian Electrotechnical Committee).

Czecho-Slovakia: Prof. V. List (Chairman, Czecho-Slovakia Electrotechnical and Standards Committee).

France: M. E. Roth (Société Alsacienne de Constructions Mécaniques).

Germany: Prof. Dr. P. Strecker (President, German Electrotechnical Committee).

Holland: Prof. C. Feldmann (President, Dutch Electrotechnical Committee).

Italy: Signor G. Semenza (President, I.E.C.).

Norway: Mr. E. Heiberg (Director, Norwegian Industrial Standardisation Bureau).

Poland: Mr. Roginski ((Secretary, Polish Standards Committee).

Russia: Prof. M. Châtelain (Chairman, Russian Electrotechnical Council).

Sweden: Mr. A. F. Enstrom (President, Swedish Standards Committee).

Switzerland: Mr. E. Huber-Stockar (President, Swiss Electrotechnical Committee).

It must have been a source of extreme gratification to that wonderful old man, Colonel Crompton, to move about as he did throughout the voyage with all the enthusiasm and activity of youth, among this body of world-famous engineers brought together largely through his own instrumentality. It will be remembered that the International Electrotechnical Commission owes its inception to a paper which he presented at the St. Louis Electrical Congress in 1904.

The present General Secretary, Mr. C. Le Maistre, to whose energies both in the preliminary preparations and during the voyage, it is largely due that the visit to America is proving such a great success, has also worked with the I.E.C. since its inception. As is well known, he has also been closely associated with engineering standardisation in this country through the B.E.S.A. for upwards of twenty-five years, and during that time he has materially contributed to bringing its objects to fruition.

At the close of the Congress of 1904, a resolution was adopted by the Chamber of Government Delegates to the effect that steps should be taken to secure the co-operation of the technical societies of the world by the appointment of a representative Commission to deal with electrical standardisation.

Two years later thirteen nations sent delegates to a conference in London presided over by Mr. Alexander Siemens, and the I.E.C. was then constituted on a permanently organised basis.

International meetings have been held during the past twenty years in Brussels, Turin, Cologne, Paris, Zurich, Berlin, Geneva, and The Hague, and to all these meetings the Americans have sent delegates, often in considerable numbers. It is therefore an event of great importance that after such a period of useful development the seal should be set on the Commission's active growth by the acceptance of an invitation from across the Atlantic by a body of engineers representative of all interests.

Col. Crompton and Sir Archibald Denny.

Herr Stolz, Dr. K. W. Wagner, Col. Crompton, Mr. Ll. B. Atkinson, and Mr. C. P. Sparks, ready to land.

Mr. P. F. Rowell and Prof. V. List.

On Good Friday afternoon the *Andania* steamed down the Channel in brilliant sunshine, but we were not to be let off so lightly for very long. During the night the meaning of the Atlantic swell became evident, and then the weather became worse until a strong cold head wind, amounting at times to a gale, and a rough sea, took all interest out of life for many of the delegates.

The cordial greeting received by wireless on Saturday from the American Committee had a special significance, and hearty support was given to the reply, in which all joined in the keen anticipation of setting foot on the hospitable and immovable soil of America.

On Easter Monday, the *Aquitania*, also sailing to New York, but at a much higher speed, pased us, and the usual facetious greetings were flagged across the few hundred yards that separated us. Offers to tow and threats to report for excessive speed were equally ignored, however, and she passed ahead out of sight to reach New York days before we did.

The weather continued bad, so that one evening, out of ninety stalwart delegates, only about ten faced dinner; but time brought its own cure, and by Tuesday the weakest member was sufficiently recovered to attend an informal reception by the President, Signor Guido Semenza, in the ship's lounge.

Signor Semenza apologised for not having called the meeting earlier, and hoped that as Captain of the Conference in New York, he would prove a better sailor than on the Atlantic. He explained that although no official meeting was possible in the absence of the American delegates, it was important for the various members to get together and make each other's acquaintance so that the informal exchange of views might facilitate the work of the Conference later on. The General Secretary, Mr. C. Le Maistre, then read the names of the members constituting the different committees, and Sir Archibald Denny, chairman of the oldest standardising body in the world—the British Engineering Standards Association—said a few complimentary words on the success of the I.E.C. in bringing together so many distinguished members under such a distinguished president.

In spite of the unpleasant weather encountered on the Atlantic, the voyage was made a very happy one by a series of sports and social events organised by an entertainments committee under the able presidency of Colonel Edgcumbe. The British delegates took high places in the competitions, Mr. S. C. Bartholomew scoring a great success in a fancy dress competition, of which some snapshots are reproduced herewith.

By a happy thought, the Cunard Company gave a dinner one evening in Mid-Atlantic in honour of the Electrotechnical Commission, at which speeches were made by Sir Archibald Denny and Signor Guido Semenza. There was unanimous support from all present for the sentiments expressed by both speakers with regard to the excellent service and the arrangements made for the delegates' comfort during the voyage. After the health of the chef had been drunk, and responded to by that august Frenchman in a few admirably chosen phrases, Herr Hoenig, Chairman of the Swiss Committee, supported the thanks to the ship's staff in half a dozen languages, concluding with an original witty poem in German, detailing the voyage of the good ship *Andania*, and the company adjourned to the lounge, where an excellent concert was enjoyed until a late hour. Among the first-rate musical talent aboard, the delegation was fortunate in having as a fellow passenger a well-known modern composer, and when his next song is being widely sung, many will recall how he favoured the I.E.C. with the first public performance of it, from his rough manuscript in mid-Atlantic. The gathering resulted in a handsome collection in aid of seamen's charities.

Early on Sunday morning, April 11th, the *Andania* called at Halifax, Nova Scotia, and on Tuesday, the 13th, the skyscrapers of New York towered up alongside. The European delegation had arrived.

The delegates were welcomed at the pier by a committee headed by Dr. John W. Lieb and Prof. Elihu Thomson, and were taken to the Hotel Astor, where they were quartered during the Conference, in a special fleet of motor cars decorated with the blue and white flag of the Commission.

On Tuesday evening, April 13th, an official welcome was given to the delegation at a meeting held in the auditorium of the Engineers Societies Building, under the chairmanship of Dr. Lieb, chairman of the Reception Committee. Telegrams from Mr. Thomas Edison and Lord Balfour were read, and the Secretary of Commerce, Mr. Hoover, being unable to attend as arranged, spoke a few words of welcome from his home in Washington by means of amplifiers and loud speakers in the hall. In extending the welcome of the United States Government to the members of the International Electrotechnical Commission, he said: "The subjects you are about to consider are of the first importance to the continued progress of electrical science and of industry, and I need not say that your labours and the conclusions that you reach are also of the first importance to all your respective countries and to mankind in general. If we would have the freest flow of discovery and invention in electricity we must have common terms and common standards."

Dr. Elihu Thomson, in his words of welcome, spoke of the achievements of the I.E.C. during the past quarter of a century, and then proceeded to touch upon some of the wonders which would be shown to the delegates.

Dr. Howard T. Barnes spoke on behalf of the Canadian National Committee, and was followed by Colonel Crompton, who received an enthusiastic greeting from the meeting, the entire body of delegates and guests rising and cheering him. Colonel Crompton ran over his early experience in founding the I.E.C., showing how the progress had necessitated considerable tact in bringing together opposing interests. Now, for the first time since the war, representatives of all the nations of the world, including ancient enemies (now become friends), had come together, and he believed that it was the pleasure of doing this work that kept him alive.

After Monsieur Genissieu (France), Mr. Enstrom (Sweden), Prof. List (Czecho-Slovakia), and Dr. Strecker (Germany) had spoken as representatives of the nations of Western, Northern, Eastern, and Central Europe, respectively, Signor Guido Semenza, the President of the Commission, delivered an address on the "Accomplishments and Aims of the International Electrotechnical Commission."

At a luncheon given by the United States National Committee, at the Commodore Hotel, New York, on April 14th, an able and effective speech was delivered by Dr. Michael Pupin, President of the American Institute of Electrical Engineers. As a student at college Dr. Pupin learned that the Greek philosopher said that "To know thyself is the first step to wisdom." After 40 years he had concluded that the second step to wisdom was "to know thy neighbour." "In Europe," he said, "we suffer from neighbourphobia. Everybody's afraid of his neighbours," and then he described how as a boy he lived in a simple Serbian village near the Danube where within 20 miles there were 12 villages representing five different races—Serbs, Hungarians, Germans, Slovak, and Rumanians—and yet they were the happiest people on earth. Why? Because every village had its market days, when the peasants from other villages came to trade, and when they enriched their experience by the experience of their neighbours. They welcomed one another as neighbours, and, looking at the delegates from all over the world, Dr. Pupin felt that the best greeting he could give was the old Serbian one: "Welcome, our dearly beloved neighbours."

Sir Archibald Denny, in replying on behalf of the visiting standardising bodies, referred at some length to the activities of the British Engineering Standards Association. He hoped that a hearty effort would be made during this visit to lay the foundation of an international standardising association.

Signor Semenza, in a witty speech, spoke of the great painter who explained that his best picture was due to his efforts to attain the high quality of the frame purchased for it by the man who ordered it. In the frame of welcome and entertainment provided by the Reception Committee the Commission must provide a beautiful picture in the work carried out in the technical sessions. Dr. Sharp, President of the U.S. Committee, and Dr. Mailloux, past-president of the I.E.C., also spoke.

The technical sessions of the Conference opened at 9.30 on Wednesday morning, April 14th, and continued daily, morning, afternoon and evening, until the 22nd.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

New Businesses Registered.—The following businesses have recently been registered under the Business Names Act:—

N. W. J. Gorrill & Co. (radio and electrical factors), 6, Clapham Court Terrace, Kings Avenue, S.W.4.

Radio Services (radio accessories, sets and tools), 2, Winchester Street, Salisbury.

Piccadilly Sign Co. (electric signs), 22-24, Charing Cross, Whitehall, S.W.1.

South Wales Electric Lamp Service (electrical engineers), 3, Temple Buildings, Goat Street, Swansea.

Adelphi Electrical Co. (electrical engineers and contractors), St. Stephen's House, Victoria Embankment, S.W.

Aldwych Engineering Co. (general engineering supplies), 71, Lincoln's Inn Fields, W.C.2.

Northern Electric Co. (electrical contractors and wireless dealers), 292, Stratford Road, Manchester.

Rays Wireless Stores, 87a, Seven Sisters Road, Holloway, N.7.

Gordon Radio Co. (manufacture and sale of wireless apparatus), 69-73, Mansell Street, Aldgate, London.

Thrale Engineering Co. (electrical and mechanical engineering), Cromwell House, Fullwood Place, W.C.1.

I. C. Tofield & Co. (electrical engineers and representatives), 110, Dale End, Birmingham.

Unemployment.—The total number of persons registered at the exchanges as wholly unemployed on April 12th was 1,024,400. This was 25,386 less than on April 5th and 180,370 less than on April 13th, 1925.

The E.T.U. and Fusion.—The members of the Electrical Trades Union are to be consulted by means of a ballot upon the question of merging the organisation in the Transport and General Workers' Union which has already absorbed a number of trade unions.

Employment during March.—Although the general tendency of employment during March was improvement, the *Ministry of Labour Gazette* shows that this did not apply to the engineering industry in which, as a whole, there was a general decline. In the electrical engineering section unemployment increased from 6.6 to 6.7 per cent. and compared badly with the proportion of 5.5 per cent. in March, 1925. On the other hand, conditions improved in the electrical wiring and contracting industry and in electrical cable, wire and lamp manufacture. In these groups the percentages of unemployed were 7.9 and 7.4 respectively, as compared with 8.6 and 7.8 per cent. in February. Improvements also occurred in the transport section and in the gas, water, and electricity supply industries as a whole.

The Timber Market.—Our timber trade correspondent reports that the market for timber for general construction work is more healthy than it was a month ago. Although there are still large stocks on the market the consumption has shown considerable improvement, and is likely to increase in that respect provided labour troubles in the mining and engineering industries are avoided. Housebuilding is proceeding splendidly, thus creating a good demand for general wood requirements. Hardwoods for the cabinet and fancy box trade are in fair request, and at firm rates, especially teak, rosewood, and ebony. Mahogany is not quite so strong in value, comparatively, as the other descriptions mentioned, increasing supplies having arrived this year compared with the corresponding period of 1925. Taken generally, however, there is an improvement in the call for that choice wood compared with a month ago, the demand for good quality material especially being very satisfactory.

Social Event.—The first dinner of the Cambridge Instrument Co., Ltd., was held at the Hotel Russell on Saturday, April 17th, when Mr. S. W. Hersant presided over an assembly of 120. The guests of the evening included the directors of the company, Mr. R. S. Whipple, Mr. C. Mason, Mr. R. W. Paul, Mr. F. Wakeham and Mr. W. H. Apthorpe, with their ladies. The event concluded with a dance.

The L.C.C. and Foreign Purchases.—The General Purposes Committee of the London County Council reports that it has considered the difficulties which British manufacturers have to face in competing with firms in a foreign country with either a low rate of exchange or low rates of wages in operation, and whether the Council should, in dealing with tenders for articles of foreign manufacture, pay regard to the economic conditions of the country in which the articles are produced. The Committee's practice is to concur in preference being given, within limits, to British, as against foreign, tenders. It has decided that it could not advise the Council to go beyond this and to bar all tenders for goods of foreign manufacture, or to undertake the practically impossible task of assessing the relative economic factors in the countries concerned in any particular case.

Canadian Radio Exhibitions.—The *Board of Trade Journal* states that a National Canadian Radio Exhibition is to be held at Toronto from October 25th to 30th. Similar exhibitions are to be held at Winnipeg from September 13th to 19th, and at Montreal from October 4th to 9th. Inquiries should be addressed to the Canadian Exhibition Co., 204, King Street East, Toronto.

New Municipal Showrooms.—The Shoreditch Lighting Committee has recommended to the Borough Council that premises be purchased for a showroom and demonstration purposes. The total estimated expenditure will be £12,500, including alterations and equipment.

E.D.A. Activities.—We have received another batch of pamphlets from the British Electrical Development Association. They maintain the E.D.A. traditions of "readability," effective argument, and attractiveness, and should prove useful to supply authorities and others engaged in increasing the load. The new publications deal with the domestic applications of electricity, electric vehicles, and electricity for power purposes. Accompanying the leaflets is a short pronouncement upon the multi-part tariff system received from the State Electricity Commission of Victoria.

Local Exhibitions.—St. Helens.—At the recent electrical exhibition organised by the Corporation Electricity Department, the General Electric Co., Ltd., had a very attractive display. A range of "Magnet" domestic electrical appliances were exhibited and demonstrated, and included a refrigerator, cooker, wash-boiler, egg whisks and other appliances. A section of the G.E.C. stand, illustrated in the picture herewith, was made up in the form of shop windows, and the space, dressed by local retailers, was used to demonstrate the "Cecoray" system of shop-window lighting. The general lighting of the rest of the stand was very effective.

The G.E.C. Stand at St. Helens.

Proposed Tasmanian Hydro-Electric Grant.—After an investigation carried out at the request of Mr. Bruce, the Australian Prime Minister, Sir Nicholas Lockyer has issued a long report on Tasmanian disabilities as a result of federation, containing a number of recommendations. Among these is a proposal that the Commonwealth Government should make a grant of half a million pounds to relieve Tasmania of a portion of the capital cost of the hydro-electric scheme in consideration of the State's assistance in having established an electrolytic zinc industry.—*Reuter* (Melbourne).

Electrical Imports of the Philippines.—Mr. T. Harrington, British Consul-General at Manila, has forwarded a report on the commercial and economic situation of the Philippine Islands, to June, 1925, to the Department of Overseas Trade (Stationery Office, 9d. net). This shows that the total value of electrical machinery imported during 1924 was £481,807, as compared with £247,071 in 1923, the proportion of the total imports thus rising from 1 to 2 per cent. As was the case in most other commodities the United States was pre-eminently the principal supplier contributing goods to the value of £438,974 in 1924, Great Britain's share being only £2,421.

Hours of Work in Australia.—The N.S.W. High Court, on April 19th, upheld the appeal of three New South Wales firms against the judgment of a magistrate that employés working under the Federal 48-hour week award were entitled to full wages for 44 hours' work, under the State Act. The Court decided that the 44-hour week was not applicable to employés in industries covered by the Federal award. The employers are reported to be gratified at the Court's decision and anticipate a period of greater prosperity in the industrial world. The Trades Unions are disappointed. Fifty thousand workers are affected and 2,000 employés of the Clyde Engineering Company downed tools for a day as a protest.—*Reuter* (Sydney).

The Chinese Attitude.—A writer in the February *Journal* of the Associated Chambers of Commerce in China and Hongkong deals with the age-long exclusiveness of the Chinese and their antipathy to foreign ideas and products. He considers that all indications point to an augmentation of this sentiment in recent years, and that the result will be a constant endeavour to impose heavy tariffs upon foreign goods to protect and foster native industries. "The tendency will be towards the exclusion of all foreign things. China for the Chinese and all goods to be supplied by the country itself is the tendency of the Chinese mind; the traditional spirit of exclusion will be carried out in all departments of life."

Threatened Tramway Strike at Manchester.—At a meeting of the employés of the Manchester Tramway Department, last week, it was decided to cease work on Whit Monday and three succeeding days as a protest against the refusal of the City Council to grant the men an extra four days' holiday. They already receive eight days per annum.

Trade Announcements.—MR. S. WHISTON, late with Carrington & Button, has commenced business as an electrical engineer at 12, West Street, Crewe.

THE WENHAM LIGHTING CORPORATION, LTD., of 184, Gray's Inn Road, the whole of the share capital of which is held by the Whitworth Electric Lamp Co., Ltd., has acquired the business of the Dawson Electric Co., St. Peter's Church Walk, Nottingham, and it will conduct this business as a branch. Mr. A. E. Dawson, formerly proprietor, has been appointed managing director to the Wenham Lighting Corporation, Ltd., and he will manage both businesses from 184, Gray's Inn Road, W.C.1.

MESSRS. R. A. EVANS, LTD., of Leicester, have opened a district office at 46, Grosvenor Chambers, Deansgate, Manchester ('Phone: "City 4550"), under the direction of Mr. E. Grayson Holt, to deal with business in the Lancashire and Yorkshire area.

MR. S. D. SCHOFIELD has removed from Penistone to Bolton, and his address is now: Engineer Representative, Holophane, Ltd., 23, Yarrow Place, Bolton.

Lead.—Reporting on April 24th, Messrs. James Forster and Co. stated:—"The demand from cable makers is still very disappointing. . . . The key of the position seems to lie with Germany. As long as this market is used for the dumping ground of surplus lead from the Continent, so long will the price remain depressed. When the Continent resumes taking its normal quantities, the position will be quickly relieved here, and if this were to coincide with better buying by cable makers, we should quickly see the price over £30 per ton again."

Catalogues and Lists.—MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Price List 391/1, giving particulars of lighting fittings for mining service. Fully illustrated.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—Folder No. 1010, illustrating and describing the "Single Cord" ceiling switch. Priced.

THE EAGLE ENGINEERING CO., LTD., Eagle Works, Warwick.—A price list of electrical accessories, fittings, switchgear, &c.

HOUGHTON-BUTCHER (GREAT BRITAIN), LTD., High Holborn, W.C.1.—"Houghton's Radio News," containing illustrated and priced details of radio apparatus of all makes. Articles on window-dressing and other sales subjects appear.

MESSRS. F. V. COLLINS & CO., 155, Kingston Road, Wimbledon, S.W.19.—A card advertising the "Newlink" solderless connector for radio work. Priced.

ELECTRADIX RADIOS, 218, Upper Thames Street, E.C.4.—An illustrated and priced catalogue of radio apparatus and electrical appliances.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—A number of illustrated catalogue sheets, dealing with many examples of the company's manufactures, superseding lists previously published.

MESSRS. DE LEEUW & CO., LTD., Sentinel House, Southampton Row, W.C.2.—A reprint of an article dealing with Freed-Eisemann radio apparatus.

MESSRS. EDWARD DEANE & BEAL, LTD., 3, Monument Street, London Bridge, E.C.3.—A brochure illustrating and describing "Consummate" evaporative condensing plant.

TRELLEBORG EBONITE WORKS, LTD., Audrey House, Ely Place, E.C.1.—A showcard advertising the company's ebonite sheet, tubes, rods, &c., and a price list of ebonite panels.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—A series of illustrated pamphlets, giving full details of the company's cable boxes of many types, mainly for use with oil-immersed transformers.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, Essex.—Lists 260 and 261, giving prices and particulars of "Sparta" low- and high-pressure batteries for radio work.

MESSRS. CAMPBELL & ISHERWOOD, LTD., Raleigh Street, Bootle, Lancs.—An illustrated pamphlet advertising portable electric grinders and hand drills.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—A priced and illustrated pamphlet dealing with the Philips rectifier for battery charging.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—A well-produced illustrated brochure describing twelve 12,500-kVA, 110,000-V transformers supplied to the Tata Power Co., India.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—A well-illustrated, priced catalogue of "Silverstone" lighting glassware, including bowls, shades, &c.

ORION LAMPS, LTD., 15, Eldon Street, E.C.2.—A price list of "Orion" vacuum and gasfilled lamps of several types.

MESSRS. J. W. BROOKE & CO., LTD., Adrian Works, Lowestoft.—A pamphlet advertising the "Brooke" 40/60-h.p. marine engine.

HIGGS MOTORS, Witton, Birmingham.—A stock list of a.c. and d.c. motors of all sizes and patterns.

MESSRS. CROMPTON & CO., LTD., Chelmsford.—An illustrated booklet describing the construction and uses of the "Alltest" d.c. instrument, which can be employed as a voltmeter, ammeter, resistance indicator, &c.

THE STANDARD SPRING CO., Bank Street, Hall End, West Bromwich.—A folder illustrating various patterns of springs made by the firm.

Book Notices.—"The Anglo-American Year Book, 1926." (Pp. 504.) London: American Chamber of Commerce in London. Price 15s. net.—This year book is a mine of interesting facts and figures for those who desire to foster Anglo-American relationships. A number of special articles appear in the 1926 edition, including two on legal matters from the English and American points of view. Mr. Nutting, of the American Consulate-General, contributes statistics of trade between the two countries during 1925.

"Kelly's Directory of the Electrical Industry, Wireless and Allied Trades." (Pp. xxvi + 1,256.) London: Kelly's Directories, Ltd. Price 30s. post free.—This, the third, edition of the directory has been thoroughly revised—no light task in view of the continuing expansion of the industries covered. The body of the volume consists of a county directory, the towns being arranged under their counties in alphabetical order. The names of contractors, &c., and other details, are given. In addition to this there are alphabetical and classified lists of electrical firms; a directory of supply undertakings; and a list of trade names. It is of interest to note that the volume contains the names, &c., of 4,500 radio retailers.

"Post Office Electrical Engineers' *Journal*." Vol. XIX. April, 1926. London: Electrical Review, Ltd. Price 1s. 6d. net.

"The Mining Electrical Engineer." Vol. VI, No. 67, April, 1926. Price 1s. net.

"*Proceedings* of the Rugby Engineering Society." Vol. XIX, Session 1924-5. Published by the Society. Price 10s. 6d.—The total membership of the Society at the end of the year in question was 367, as compared with 346 for the previous year. The revenue for the year was £255, resulting in a balance of £18.

Bankruptcy Proceedings.—M. D. ROSENBLOOM (trading as D. Rose & Co.), electrical engineer, 25, Osborn Street, London.—An application was made on April 20th to Mr. Registrar Mellor, at the London Bankruptcy Court, for an order of discharge on behalf of this bankrupt, who failed in January, 1924. Mr. V. Armstrong, Official Receiver, reported that the liabilities amounted to £3,657; the assets, valued at £515, had realised £342, and a first and final dividend of 1s. 1d. in the £ had been paid. Born in Russia, the bankrupt came to this country in 1898 and had not been naturalised. He commenced business in 1904 and was successful until 1923, when an action was brought against him for the infringement of electric lamp patents. Following a private meeting of creditors a deed of assignment was executed, but the bankruptcy proceedings supervened on a creditor's petition. The application was opposed by the Official Receiver on the grounds (1) insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; (2) omission to keep proper books of account; (3) trading with knowledge of insolvency; (4) failure to account satisfactorily for the deficiency in assets to meet the liabilities; and (5) misconduct in relation to the supply of accounts and non-attendance as often as required on the Official Receiver and the trustee. His Honour suspended the discharge for three years.

G. R. SPARROW, 11, Cloudesdale Road, Balham, late of Brixton, electrical engineer.—The receiving order in this matter was made recently on debtor's own petition. The statement of affairs shows liabilities of £492, against assets of £11, leaving a deficiency of £481. Debtor attributes his failure to unemployment and illness. In 1921, with £30 capital, he commenced business in partnership with his son and another at Beer Lane, E.C., as electrical engineers and contractors. The business was successful until March, 1922, when illness kept him away. Upon his return, he found that the business had declined and creditors were pressing. A meeting of creditors was held in July, 1922, but no action was taken, and the landlord subsequently sold the stock for rent, and the business ceased.

THOMAS BARTON, electrical engineer, formerly carrying on business at Ainsworth Street, Blackburn.—This debtor applied for his discharge at Blackburn County Court, on April 19th. The Official Receiver said that a first dividend of 15s. in the £ had been paid, and a further dividend was probable. Bankrupt's conduct had been very satisfactory. Judge Bradley said that Mr. Barton's conduct had been estimable in every respect. He granted an immediate discharge.

C. J. NICHOLS (C. J. Nichols & Co.), 7, Park Street, Bridgend.—First meeting, April 30th. Public examination May 14th, at the County Court, Bridgend.

W. C. Rhodes (L. J. Palmer & Co.), electrical engineer and contractor, 141, Newspaper House, Corporation Street, Birmingham.—Last day for proofs for dividend, May 6th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

J. McFadden, electrician, 177, Higher Hillgate, Stockport.—First meeting April 30th, at the Official Receiver's Office, Byrom Street, Manchester. Public examination June 1st, at the Court House, Stockport.

Company Liquidations.—Radio Equipment Co., Ltd., 5, Dyers Buildings, Holborn, E.C.—Under a compulsory winding-up order made against this company on March 2nd, upon the petition of a creditor, the statutory first meetings of the creditors and shareholders were held on April 20th, at Carey Street. The Official Receiver reported that accounts had been lodged showing unsecured debts £5,575; preferential claims £31, and loans on debtors' bonds, £979; assets valued at £314, and a total deficiency of £6,273 with regard to contributories, the issued capital being two £1 shares. The company was formed as a private company in July, 1922, with a nominal capital of £100, to carry on business as manufacturers of and dealers in wireless equipment and primarily to act as selling agents for radio goods to John Hall & Co., of Birmingham. The promoter was Mr. P. J. White, and the failure of the company was attributed to increasing difficulties in competing with foreign manufacturers, by reason of which the margin of profit was too small; also to insufficiency of capital to enable the company to advertise adequately. The chairman added that he had collected approximately £30 from the assets and was unable to say whether anything like the estimate of £314 would be realised. A liquidator was appointed.

Hawk Coil Co., Ltd., wireless manufacturers, St. Mary's Road, Surbiton.—The creditors were called together on April 20th at the offices of Mr. F. Bryant, 16, Clapham Junction Station Approach, S.W., who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. A statement of affairs was presented which disclosed liabilities of £1,582, all due to unsecured creditors, and net assets of £135, leaving a deficiency of £1,447. The Liquidator stated that the company was incorporated in May last with a nominal capital of £1,500, of which £1,255 had been issued. Of the latter amount £750 represented the purchase consideration for the business taken over, and the balance was cash. The turnover since the incorporation had been about £2,400, and there had been a loss on the trading of over £500. In January last the coil which the company made was greatly improved, and it necessitated the existing stock being broken up. The patent was estimated to be of no value. It was decided that the voluntary liquidation should be continued with Mr. Bryant as liquidator with a committee of inspection. The following are creditors:—

	£		£
Bankers	204	Spears & Co.	54
Ankh Insulator Co. ...	80	Solidite Mfg. Co., Ltd. ...	35
Barclay's Advertising Co.	59	Trader Publishing Co. ...	50
Coley, R. J.	332	Walker & Co.	168
Coley, R. J., Ltd.	51	Horry Offer, Ltd.	50
Hopes, Ltd.	20	Parker, Turnbull & Co. ...	30
Phillipson's Press, Ltd. ...	212		

A. Emanuel & Sons, Ltd., George Street, Manchester Square, W., electrical engineers, &c.—A meeting of creditors was held on April 22nd at Andertons Hotel, Fleet Street, E.C., when the representative of Messrs. Walkers, Parker & Co., Ltd., London, the largest trade creditors, was elected to the chair. The chairman said that the firm was a very old-established one, and had always enjoyed a good reputation. All were sorry that it had come down. Mr. Walter Boniface, the receiver for the debenture holders, and the liquidator in the voluntary liquidation of the company, presented a statement of affairs, which showed liabilities of £17,920, all due to trade creditors. In addition, there were fully secured creditors for £30,360, against which they held security valued at £51,460, leaving a surplus of £21,100. The bank was creditor for £14,677, and held debentures for £15,000. The net assets were £57,006, leaving a surplus of £39,146 as regarded the creditors. The liquidator reported that the company was incorporated in 1885 with a nominal capital of £58,500, which was increased in 1889 to £100,000. The issued capital amounted to £83,500. The company was formed for the purpose of acquiring the business previously carried on by Mr. Abraham Emanuel, who became the sole director, and he also appointed his son, Mr. Elliott Emanuel, to be a director. Mr. Abraham Emanuel died in 1894, and Mr. Elliott Emanuel in 1904. Since that time there had been various changes in the directorate, and the present directors were Mr. A. Emanuel, Mr. T. Rose, Mr. D. R. Fraser, and Mr. O. G. Cooper. Mr. Alfred Emanuel was the managing director. The fees of the directors were limited to £100 per annum each, but they had been engaged in other capacities in the company and had received salaries. The balance sheet at December 31st, 1920, showed surplus assets of £10,769. The sum of £18,190 was written off as loss for the year 1921, and there was a reserve to carry forward to 1922 of £15,273. The year 1922 resulted in a further loss of £16,590, so that there was on January 1st, 1923, an adverse balance of £1,317, and further losses were incurred as follows: 1923, £10,583; 1924, £1,847; and 1925, £6,555, making a total of £20,302 to December 31st, 1925. The directors attributed the loss in 1921 to a big drop in the turnover following the "boom" year of 1920. They stated that the losses incurred in 1922 and 1923, were largely accounted for by a drastic writing down of stocks in addition to reduction in selling prices. In order to provide working capital, debentures were issued from time to time, and in July, 1922, there were in existence first debentures for £5,000 and second debentures for £25,000. The latter were held by the bank to secure an overdraft of £24,150. An advance of £30,000 was later obtained. The overdraft to the bank had been repaid, and the first debenture of £5,000 was paid off. Further funds being required to carry on the business, first debentures were issued for £6,000, £4,000, and £5,000 to the bank. The directors were unable to repay the bank, and on March 17th last the bank appointed Mr. Boniface as receiver. The latter immediately consulted the largest creditors, and it was decided that voluntary liquidation should take place. Accordingly, the necessary resolutions were passed by the shareholders on April 7th last.

Mr. W. Baker, of the Wholesale Traders' Association, said that this was one of the few cases met with at the present time where there was a substantial surplus of assets, and there was every prospect of the creditors receiving payment in full. He suggested that the voluntary liquidation of the company should be continued. It was unanimously resolved that the voluntary liquidation should be confirmed, with Mr. Boniface as liquidator, whilst an advisory committee was appointed consisting of the representatives of Messrs. Stewarts and Lloyds, Ltd., and the Armorduct Cable Co.

The following are creditors:—

	£		£
Armorduct Cable Co., Ltd. ...	413	Metallic Seamless Tube Co., Ltd.	93
Atlas Carbon & Battery Co., Ltd.	55	Midland Electric Mfg. Co., Ltd.	101
Bayley & Halstead, Ltd.	83	Newton, J. M. & Sons, Ltd. ...	124
Belling & Co.	57	Nettlefold & Sons, Ltd.	103
Bisseker, H., Ltd.	55	North Bitchburn Coal Co., Ltd.	75
Blundell, Spence & Co., Ltd. ...	143	Perfecta Seamless Steel Tube and Conduit Co., Ltd.	116
Braby, F., & Co., Ltd.	82	Planet Foundry Co., Ltd. ...	65
Brimsdown Lead Co., Ltd. ...	103	Russell, J., & Co., Ltd.	55
Cameron & Robertson, Ltd. ...	147	Scottish Tube Co., Ltd.	191
Central Cables & Accessories, Ltd.	132	Scupham & Wood, Ltd.	52
Crabtree, J. A., & Co., Ltd. ...	97	Standard Gas Fittings Co., Ltd.	109
Davies, Kent & Stewart, Ltd.	80	Standard Metals, Ltd.	104
Davis, C., & Co.	506	Stearn Electric Co., Ltd. ...	253
Foster Engineering Co., Ltd. ...	98	Stewarts & Lloyds, Ltd.	789
General Electric Co., Ltd. ...	325	Stewarts & Lloyds, Ltd.	408
Hadfields, Ltd.	111	Thompson, S., & Co., Ltd. ...	124
Hawkins Bros. & Co., Ltd. ...	60	Tipper Bros.	78
Hayward, Tyler & Co., Ltd. ...	197	Tucker, J. H., & Co., Ltd. ...	53
Huntalite, Ltd.	54	Twigg, C., & Co.	65
Hutchison, A., & Son, Ltd. ...	102	Twyfords, Ltd.	213
King, C. E.	114	Vulcan Electric & Mechanical Co., Ltd.	234
Kingsland Steam Joinery Works, Ltd.	226	Walkers, Parker & Co., Ltd.	7,021
Lancaster & Co., Ltd.	92	Walworth-Munzing, Ltd. ...	92
Leach, S. G., & Co., Ltd. ...	66	Whitley Partners, Ltd.	58
London Galvanized Iron Co., Ltd.	56	Wootton, H. A., & Co.	50
Markt & Co., Ltd.	64	"Z" Electric Lamp & Supplies Co., Ltd.	110

East Anglian Electricity, Ltd.—A meeting of members is called for May 26th, at the Great White Horse Hotel, Tavern Street, Ipswich, to hear an account of the winding up from the Liquidator, Mr. C. P. Dawes.

Northern Radio Co., Ltd.—A meeting of members will be held at 12a, Hyde Street, W.C., on May 26th, to hear an account of the winding up from the Liquidators, Messrs. W. A. Appleton and W. L. Sibley.

H. E. Davis, Ltd.—A petition for the winding up of this company has been presented to the High Court by Messrs. Albert Lee & Co. (1923), Ltd., creditors, of 8 & 9, New Zealand Avenue, E.C., and will be heard in London on May 4th.

British Wireless Supply Co. (1924), Ltd.—A petition for the winding up of this company has been presented to the County Court of Yorkshire by Messrs. Ellison & Hillman, radio factors, 123, Albion Street, Leeds, and will be heard at the County Court, Leeds, on May 4th.

Roto Sign Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. A. Prestage, Albion House, Westminster, S.W.1. Meeting of creditors May 6th, at Albion House. Particulars of claims to the Liquidator by May 24th.

Potteries Radio Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. O. Wilson, 36, Spring Gardens, Manchester. Meeting of creditors May 3rd, at the offices of the Liquidator (This notice is formal; all creditors will be paid in full.)

Henley Engineering Co., Ltd.—Winding up order made by the High Court on April 15th.

Dissolution of Partnership.—Kelsall & Co., electrical and mechanical engineers, Glanyllyn, Taff's Well, Glamorgan.—Messrs. J. Kelsall and J. J. Croft have dissolved partnership. Mr. Kelsall will attend to debts and continue the business under the same style.

Private Arrangements.—H. Brear, electrician, Calder Wharfe Mills, Ravensthorpe, Dewsbury.—A meeting of creditors was held recently, when a statement of affairs was submitted which showed liabilities of £962, of which £472 was due to the trade and £490 to cash creditors. There was also a fully secured creditor for £147, who held securities valued at £167. The net assets were £530, leaving a deficiency of £432. The business has been in existence for many years. During 1923, 1924 and 1925, there were losses on the trading of £248, £161, and £319 respectively. Since December, 1925, there was a loss on the trading of £100. The accounts at November 30th, 1924, showed a capital of £168, and the debtor was of the opinion that his assets were worth considerably more than the amount shown in the statement. An offer was made of a composition of 10s. in the £, payable by two instalments, the last to be secured. It was agreed to accept this provided

that a satisfactory guarantee was forthcoming, failing which a deed of assignment will be executed to Mr. Walker, of Messrs. W. Dawson & Son, accountants, Bank Chambers, Dewsbury. A committee was also appointed. The following are creditors :—

	£		£
Austin, J., & Sons, Ltd.	40	Scattergood & Johnson	120
Metropolitan - Vickers Electrical Co., Ltd.	30	Taylor, J., & Son	25
		Tungstalite, Ltd.	34

RAYMOND PALMER, trading as the Electrical Supply Stores, electrical and wireless dealer, Crown Street, Halifax.—The creditors of the above were called together on April 23rd, at Bradford, when a statement of affairs was submitted which showed ranking liabilities of £3,492, all were £2,383, leaving a deficiency of £1,109. It was stated that the debtor left the Army in April, 1919, and two years later started trading as a wireless dealer from a private house. It was stated that accounts had been prepared from time to time, and in June, 1923, debtor's capital was £193, whilst by June, 1925, it had increased to practically £500. During the 21 months ended June, 1925, there was a profit on the trading of £750, whilst the drawings were £450. Since July 1st of last year there had been a loss on the trading of £700. It was stated that, in addition to the assets shown, the debtor possessed an equity in a house and other small items. A resolution was passed in favour of the execution of a deed of assignment with Mr. C. H. Baker, C.A., Standard Buildings, City Square, Leeds, as trustee, together with a committee consisting of Mr. P. S. Booth and the representatives of Messrs. Louin & Murray, E. Robertshaw & Co., Siemens Bros. & Co., Ltd., and the General Electric Co., Ltd. The principal creditors are :—

	£		£
Frenhal, D., Ltd.	64	Ward & Goldstone, Ltd. ...	58
General Electric Co., Ltd. ...	280	Baxendale & Co., Ltd.	66
Louin & Murray	163	Beardsall & Co., Ltd.	170
Robertshaw, E., & Co.	357	B.N.B. Wireless Co.	163
Siemens Bros. & Co., Ltd. ...	91	Brown Bros., Ltd.	55
Siemens & English Electric Lamp Co., Ltd.	97	Sellars, H. W., & Co.	190

For Sale.—The Superintending Engineer, N.W. District, W. & B., Department of the R.A.F., Uxbridge, invites offers for an electrically-driven pumping set. Yorkshire (West Riding) Electric Tramways Co., Ltd., has for disposal two 320-h.p. Diesel engines, coupled to two Dick, Kerr 200-kW generators, one 264-cell Tudor battery, one reversible booster, and one 10-ton overhead travelling crane. Mr. S. E. Buckley, of Oakmere Farm, Potter's Bar, invites offers for a 30-gallon National calorifier and boiler, &c. (See our advertisement pages to-day.)

Deed of Assignment.—M. MARTIN (D.B.M. Electrical Co.), 3, The Royal Arcade, and 32, West Street, Weston-super-Mare.—Particulars of claims to the Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., by May 11th.

New Czecho-Slovakian Company.—A new company has lately been formed at Aussig with a capital of 2½ million crowns and the title of the Bohmische Glühlampenfabrik Gesellschaft, to acquire and extend the Plechatry incandescent lamp works near that town.

New French Companies.—La Société des Etablissements S.N.A.P. is the name of a new company which has lately been formed in Paris with a capital of one million francs to manufacture radio apparatus.

La Société Secteur Electrique de Domme is the name of a new company which has lately been formed at Domme with a capital of 2½ million francs to supply electricity in the Department of Dordogne.

New Italian Companies.—Among the new hydro-electric undertakings recently formed in Italy are the Società Idroelettrica del Vizze, Milan, capital 120,000 lire; the Società Idroelettrica Sile, Treviso, 100,000 lire; La Società Idroelettrica Pontecorvo, 50,000 lire; La Società Idroelettrica Dolomiti, Rome, 1,000,000 lire; and La Società Idroelettrica Val d'Enza, Reggio Emilia, 20,000 lire.

The concerns recently organised in connection with the radio industry include the Società Brunet, Milan, capital 500,000 lire; and La Società Radio Elettro-Meccanica Bruno Biancoli & Co., Bologna, capital 300,000 lire.

La Società Elettro Ferrovia Trentina has lately been formed in Milan with a capital of 100,000 lire to construct an electric railway in the Trentina district.

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during February last were valued at £38,715, bringing the total for the first two months of the year to £91,122, as compared with only £46,407 in the corresponding period of 1925.

Brazilian Railway Electrification.—The British Engineers' Association reports the receipt of complete data comprising plans, details of rolling stock, permanent way, traffic reports, &c., relative to the proposed electrification of the first section of the Sorocabana Railway, Brazil, tenders for which will shortly be called for. This important undertaking covers the section between Sao Paulo and Santo Antonio, a distance of 152 km., and present indications are that over 50 locomotives will be required. The electric power will be supplied by the Sao Paulo Tramway, Light & Power Co., and associated companies.

French Thomson-Houston Developments.—It is reported from Paris that the Société Thomson-Houston has transferred its telephone branch to the International Telephone and Telegraph Corporation. A few months ago the former established a subsidiary company to work its telephone branch, one half of the capital being issued to the International Corporation for the sum of $2,000,000. Now the French company has ceded to the International Corporation the second half of the capital for an amount exceeding $3,000,000, or about 100,000,000 fr. It is stated that the telephone branch has never yielded any profits to the French company.

Polish Foreign Electrical Trade.—The *Board of Trade Journal* publishes statistics showing that during February last Poland imported apparatus, conductors, and other electro-technical materials to the value of 1,435,000 zloty (£35,000). The exports of similar goods were valued at 57,000 zloty (£1,400).

Lighting and Power Notes.

Australia.—NEW SOUTH WALES.—According to the *Australasian Electrical Times*, Mr. H. G. Carter, chief electrical engineer, N.S.W. Department of Public Works, has submitted an important report to the Government on the power resources of the State. The State was divided into three districts for purposes of the survey: The northern district, from the Manning River to the Queensland border; the central district, between the Manning River and an east-west line through Kiama; and the southern district, between the Kiama line and the Victorian border. Large central stations would serve each district, and the networks serving the latter would be gradually interconnected. In the central district, 12,000 million tons of coal can be made available, but water power resources are small—not more than 25,000 h.p. The question of circulating water will govern the possibilities of building inland fuel-fired stations. In the southern district 500,000 h.p. of the total of 700,000 h.p. of the State's water-power resources are located, and there is little coal. In the northern area there are considerable resources of both fuel and water power. In developing the State's resources, Mr. Carter says, coal will play as large a part as, if not larger than water power.

Aylesbury.—LOAN SANCTIONED.—The Town Council has received sanction to loans of £40,000 for mains and services, and £4,000 for sub-station equipment and kiosks.

Barking Town.—ELECTRICITY IN BULK.—The Urban District Council has completed arrangements for obtaining a bulk supply from the power station of the County of London Electric Supply Co., Ltd., at Creeksmouth, which it is anticipated will be available toward the end of June, upon which the Council's generating station will be closed down. The taking of this bulk supply has necessitated the erection of a new transformer station adjacent to the present generating station.

Barnes.—NEW PLANT.—The London and Home Counties Joint Electricity Authority has notified the Urban District Council that it has recommended the Electricity Commissioners to sanction the extension of the Council's power station by the installation of a 3,000-kW set.

Bexhill.—SHOP-WINDOW LIGHTING.—The Electricity Committee has recommended the following terms for electricity supply for shop-window lighting :—(a) A two years' agreement to be entered into with persons concerned, supply to be limited to the period 7 p.m. to 10 p.m. (b) Price proposed, 2d. per kWh, plus meter rent of 1s. per quarter.

Bradford.—ELECTRIC COOKERS.—The Corporation Electricity Committee has decided to introduce a scheme for letting out electric cookers on hire. The charge for large cookers will be 12s. 6d. per quarter, and for small cookers, 10s. These charges will include the cost of wiring, which will be done by local contractors. The charge for energy for cooking will be ½d. per kWh.

Brazil.—SAO PAULO.—The Sao Paulo Tramway, Light and Power Company has been granted the right of utilising rivers and land in the municipalities of Sao Paulo, Sao Bernardo, Santo Armaro, Itapecirica, Una, Conceiçao de Itanhaen, Mogy das Cruzes, Sallesopolis and Santos for developing hydro-electric energy, and extending power transmission lines to the City of Sao Paulo and to any other city for which the company has obtained a concession. It is hoped that when these new works are completed the company will be able to meet the demands of the City of Sao Paulo and the neighbouring towns.

Canada.—BATHURST, N.B.—At the coming session of the New Brunswick Legislature, authority will be sought to increase the hydro-electric plant of the Bathurst Company to 20,000 continuous h.p. At the present time the company's power plant on the Nepisiquia river is capable of developing 10,000 h.p.

Chesterfield.—PRICE REDUCTIONS.—The Town Council has reduced the charge for electricity for lighting to 4d. per kWh. Meter rents for heating and cooking have been abolished.

Continental. — ITALY. — The Società Idroelettrica Ligure Meridionale has secured a concession to establish a hydro-electric power station with a capacity of 17,354 h.p. to utilise the water power of the River Calore, near Montella. The Società Idrolettrica del Isares has also secured powers to utilise the River Isares, near Cardano, to develop 152,700 h.p.

SWITZERLAND.—The St. Gall-Appenzell Power Co. has decided to erect a large new hydro-electric station at Limmern at an estimated cost of £2,040,000.

BELGIUM.—The Société du Chemin de Fer Electrique d'Ostende-Blankenberg et Extensions, in its report for last year states that the plant at its power station at Slykens has recently been extended and now comprises four steam turbo-generators with a total capacity of 14,000 kW. In addition to furnishing the power for its light railways, the company is now supplying electricity for lighting and power purposes throughout the war-devastated area of Western Flanders. In order to maintain an uninterrupted supply a connection has lately been made with the distribution system of the Société des Centrales Electriques des Flandres which has power stations at Langerbrugge and Zeebrugge.

JUGO-SLAVIA.—Plans are being prepared for the construction of a power station to be erected at Varvariu in Central Serbia.

FRANCE.—La Société des Forces Motrices de la Valée d'Aspe has secured a concession to establish two 80,000-V transmission lines between Pau and Bedous.

The Société de l'Energie Electrique Alpine, of Gap, has secured a concession to establish a hydro-electric power station to utilise certain falls near Saulec in the Hautes Alpes Department.

Dover.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £3,000 for services.

East Ham.—LOANS.—The Electricity Committee has obtained sanction to the borrowing of £10,500 for mains and switchgear. The committee is applying for sanction to loans of £5,000 for machinery at the power station, and £14,600 for feeder cables to Manor Park sub-station.

Ecuador.—GUAYAQUIL.—The municipality has concluded a contract with the Guayaquil Electric Light Co., to provide an electric lighting service for twenty years. A hydro-electric plant will be constructed near Bucay. All equipment will be purchased abroad.—*Reuter's Trade Service* (Guayaquil).

Faversham.—LOAN.—The Town Council has applied for sanction to a loan of £2,400 for cable renewals.

Finchley.—LOAN.—The Electricity Committee is seeking sanction to a loan of £29,000 for plant and sub-stations.

Fleetwood.—NEW PLANT.—The Mid-Lancashire Electricity Board has considered the application of the Town Council for sanction to carry out electricity extensions, and has approved the proposal to spend £31,000 on the installation of additional machinery instead of taking a bulk supply from the new Ribble station at Preston.

Gravesend.—INQUIRY.—Col. Ekin held an inquiry on April 22nd, into the application of the Corporation for power to supply electricity in the parishes of Darenth, Fawkham, Hartley, Horton Kirby, Longfield, Southfleet, Stone, Swanscombe, Chalk, Denton, Ifield, Meopham, Nursted, and Cobham. Mr. R. M. Montgomery, K.C., who appeared for the Corporation and the Dartford Urban District Council, said that it was proposed that the charges for electricity in the added districts should be the same as at Gravesend. With regard to the Kent Electric Power Co., Ltd., and the West Kent Electric Power Co., Ltd., he said that they had done nothing in the area named for over 20 years, and only laid down mains after the Corporation had given notice of its intention to apply for an Order. They had had applications for supply from Greenhithe, Swanscombe, Meopham, and Denton. There was opposition by the Kent Electric Power Co., Ltd., and the County of London Electric Supply Co., Ltd., and on behalf of the former Mr. Craig Henderson, K.C., stated that the Company had a sub-station in Swanscombe, and mains were laid for supply in that area and also at Cobham and Meopham. It had spent more than half a million in developments.

Harrogate.—LOAN.—The Town Council has applied for sanction to a loan of £44,000 for electricity purposes in place of £21,281 already applied for

Hull.—ELECTRICITY SUPPLY.—The Beverley and Cottingham local authorities have applied to the Corporation for a supply of electricity, the former stipulating that the charge to consumers must not be more than 40 per cent. above that to consumers in Hull. The Corporation Electricity Committee is to consider the applications.

Irish Free State.—LETTERKENNY (CO. DONEGAL).—The Donegal Mental Hospital Management Committee is installing new electric lighting plant at a cost of £1,420.

Japan.—SHINANO-KAWA POWER STATION.—The Shinyetsu Denryoku K. K. has received the sanction of the Government to the erection of its Shinano-kawa power station, which will have a capacity of 166,000 kW. The work of construction will commence this year, and be completed in four years. The cost is estimated at 90,000,000 yen.

Llantarnam.—INQUIRY DECISION.—In connection with the inquiry held in November last by the Electricity Commissioners into the rival applications of the South Wales Electrical Power Co., and the Urban District Council, for powers to supply electricity in the Llantarnam and Llanfrechfa Upper districts, the Commissioners have granted the Council's Order, and rejected the company's application in so far as its relates to Llantarnam.

London.—SHOREDITCH.—The Lighting Committee has recommended to the Borough Council a scheme for wiring small houses for lighting only, except that a special adaptor will be fitted for an electric iron or other small domestic appliance. The scheme will apply only to houses in streets where mains are already or will be laid, and electricity will be charged for at the ordinary flat rate for lighting, plus 1½d. per kWh for rental. Payment will be made through prepayment meters. It is proposed to set aside £500 in the estimates for the current year for this purpose.

HACKNEY.—The Electricity Committee has recommended the expenditure of £11,750 and £8,250 for the erection of sub-station buildings at Stamford Hill, and the provision of plant required respectively.

Sanction has been received to a loan of £19,000 for buildings and cranes in connection with the electricity undertaking.

POPLAR.—The Electricity Committee has received sanction to loans of £23 500 for buildings, £18,500 for plant, and £7,500 for steam and feed water systems, &c.

PROPOSED CHANGE-OVER.—The Notting Hill Electric Lighting Co., Ltd., has applied to the L.C.C. for consent to an alteration in its system of supply to 400-200 V, 3-wire, d.c.

Louth.—ELECTRICITY SCHEME.—The Town Council has asked the Electricity Commissioners to supply the names of six firms of electrical engineers whose terms to prepare a report on an electricity scheme are to be ascertained.

Luton.—ELECTRICITY EXTENSIONS.—The Electricity Committee has decided to increase the boiler capacity at the power station at a cost of £14,500, and to install converters, &c., at a cost of £14,000.

Newport (Mon.).—LOAN.—The Electricity Committee is seeking sanction to a loan of £3,000 in connection with its assisted wiring scheme.

Newport Pagnell.—OPPOSITION TO SCHEME.—The Rural District Council has decided to oppose a proposal of the Northampton Electric Light & Power Co., to erect poles in Olney, for overhead cables.

Northern Ireland.—WHITEHEAD (CO. ANTRIM).—Application is being made to the Electricity Commissioners by Messrs. Curran Bros., Belfast, for sanction to the erection of a generating station for the supply of electricity to the town.

Peak District.—ELECTRICITY SUPPLY.—The position in regard to electricity supply in this district is becoming more complicated. The New Mills Council has refused to join with Chapel-en-le-Frith, Whaley Bridge, Disley and Maccesfield Councils in applying for an Order to supply electricity in the district, and the Councils do not feel justified in moving without New Mills' co-operation. Meanwhile the Power Development Company has applied for an Order to supply all the districts named except New Mills.

Portsmouth.—LOAN.—The Electricity Committee is applying for sanction to a loan of £37,000, in connection with the supply of electricity to its added areas.

Retford.—LOAN.—The Town Council is applying for sanction to the borrowing of £40,412 in connection with its electricity scheme.

Sale.—CORRECTION.—Under the heading "Price Reductions," we stated in our last issue that the revised private house domestic rate was 20 per cent. of the rateable value, plus 1½d. per kWh during the summer quarters and ¾d. per kWh during the winter quarters. We regret the error; the correct "unit" charges are ½d. and ¾d. respectively, the idea being, of course, to increase the summer consumption.

Sheffield.—ELECTRICITY EXTENSIONS.—The Electric Supply Committee has during the past month approved extensions and works at an estimated cost of £1,145, and extensions of mains for general distribution purposes, at an estimated expenditure of £17,361.

South Africa.—JOHANNESBURG.—According to the *South African Engineer*, work on the municipal power station extension is now in hand. The new building will house a 10,000 kW set, two boilers and pumping plant, with all accessories. It is expected that the erection of the machinery will begin about June, and be in operation by September.

DURBAN.—At the forthcoming session of the Natal Provincial Council application will be made on behalf of the Town Council for increased borrowing powers to an amount of £775,000, which will include £350,000 for electricity purposes.

QUEENSTOWN.—The Town Council is to proceed with its scheme for an entirely new power station and equipment, estimated to cost £30,000. The plant will include two 250-kW sets and two 8,800-lb. boilers.

South-East Lancashire Electricity Advisory Board.—TRANSMISSION LINE: RADCLIFFE TO PADIHAM.—The Engineering Advisory Committee has considered a proposal of the Lancashire Electric Power Co., to provide a 33,000-V transmission line to interconnect its Radcliffe and Padiham stations, at an estimated cost of £86,386, and has resolved that the scheme be approved.

ASHTON-UNDER-LYNE.—The Committee has received details of the Manchester offer for bulk supply, and an estimate of the cost of plant extensions at Ashton, and has decided that the question shall be adjourned.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

South Shields.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £10,000 in connection with the provision of pre-payment meters and wiring installations to be let on hire, and £8,500 for mains and sub-station equipment.

EXTENSION OF SUPPLY.—The Electricity Committee is to extend the electricity supply to the housing estate, at an estimated cost of £7,500.

Special Orders.—Application has been made to the Electricity Commissioners by the Aldershot Gas, Water & District Lighting Co., for a Special Order authorising it to extend its area of electricity supply, so as to include the urban district of Fleet, and certain parishes in the rural districts of Hartley, Wintney, Basingstoke, Guildford and Hambledon.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Wrexham Rural District Council to supply electricity in the district and part of the rural district of Hawarden; the Teignmouth Electric Lighting Co., Ltd., to supply in part of the rural district of Newton Abbot; and the Electrical Distribution of Yorkshire, Ltd., within the rural district of Hemsworth.

Tramway and Railway Notes.

Continental.—FRANCE.—The Compagnie des Tramways de Cherbourg has received sanction to proceed with the electrification of the steam tramway between Querquerville and Urville-Hague.

ITALY.—On April 21st, the Minister of Communications opened the section of the railway between Spezia and Sestri Levante (24 miles in length), which was recently electrified. The whole of the line between Modena and Spezia, a distance of 225 miles, has now been electrified, and it is intended eventually to continue the line as far as Leghorn. Italy will then possess the longest stretch of electrified railway track in the world.—*Reuter* (Spezia).

AUSTRIA.—The *Elektrotechnik und Maschinenbau* gives some particulars of the progress of the electrification of the railway system in Austria. The first programme included the electrification of the Salzkammergut line, which was completed in the summer of 1924, and the Alberg line between Innsbruck and Bludenz, opened in May last year. Work on the second programme was immediately commenced, this comprising the electrification of the Arlberg line west of Bludenz. Altogether 45 miles of the Vorarlberg lines are in course of electrification, while similar work has also been commenced on the lines east and south of Innsbruck, the necessary capital outlay having been voted by the Austrian Parliament. The second programme also includes the electrification of the Salzburg-Worgl and Kufstein-Worgl-Innsbruck-Brenner lines, a total of approximately 190 miles. The section between Kufstein and Innsbruck is expected to be completed by the end of the present year, those between Innsbruck and Brenner and between Worgl and Saalfelden by the end of 1927, and that between Saalfelden and Salzburg by the end of 1928. The power for the railways in this second programme will be supplied from the Lake Achen, the Mallnitz, and the Stubach hydro-electric power stations. Contracts have already been placed for the electrification of the Kufstein-Worgl-Innsbruck line, and the preliminary work is well in hand. It is estimated that 75 electric locomotives will be required in connection with the second electrification programme, orders for 42 of which have already been given.

BELGIUM.—In its report for last year, the Compagnie Générale des Tramways d'Anvers states that it is to modernise its power plant, and it has been decided to install mercury rectifiers at its transformer station in place of the rotary machines at present in use. Two new transformer stations are also to be erected—one in Antwerp and one in Hoboken.

Darlington.—RAILLESS-CAR SCHEME COMPLETED.—The conversion of the Corporation's tramway system to the railless-trolley system has been completed, the last route (Harrogate Hill service) having been inaugurated on April 11th.

Japan.—NEW ELECTRIC RAILWAYS.—Applications have been made for sanction to the construction of the following electric railways:—Between Koriyama and Yimoto-machi, Fukushima-ken; from Onomichi, Hiroshima-ken to Kouko-machi, Okayama-ken; three railways, with a total mileage of 32, in the Toyama Prefecture; and from Shimizu, Shizuoka-ken to Minobu, Yamanashi-ken, a distance of 12 miles.

Musselburgh.—PROPOSED TRAMWAY PURCHASE.—According to the *Tramway and Railway World*, the Town Council has proposed that the tramway of the Musselburgh and District Electric Light and Traction Co. in the burgh shall be taken over by the Edinburgh Corporation. The company states, however, that it is not prepared to sell the undertaking at the present time upon the same terms as laid down for 1931, and the matter has been dropped.

Southend-on-Sea.—MOTOR OMNIBUSES.—The Town Council has decided to withdraw its tramway service on the Prittlewell route, and substitute motor omnibuses, augmented by railless cars.

United States.—NEW YORK.—The *Electric Railway Journal* reports that the Board of Transportation has made a formal request to the Board of Estimate for funds amounting to $100,000,000 to be spent in the construction of new subways, including a new tube from 53rd Street to Queens.

Telegraph and Telephone Notes.

Australia.—TELEPHONE SERVICE.—The annual report of the Postmaster-General shows that the telephone service working cost, for the 12 months ended June 30th, 1925, was £3,128,913, and the total revenue was £3,661,110, leaving a gross surplus of £532,196. Interest charges, however, exceeded that amount by £258,619, which represented a loss on the year's working. Capital expenditure, says the *Australian Electrical Times*, was approximately £4,000,000. Arbitration awards imposed an extra burden of £144,000 in wages during the year, in which 14,379 new telephone subscribers were connected in the metropolitan areas, and 20,301 in country districts.

TELEGRAPH SERVICE.—The telegraph services made a working loss of £53,886 for the 12 months, or, with interest added, a total loss of £227,174.

Bolivia.—RADIO-TELEGRAPHY.—The Government has thrown open for public use the 13 Marconi stations throughout the Republic in order to facilitate general communication. Heretofore the Government has prohibited the popular use of its system, the theory being that the Government service for administrative and military matters would be interfered with. According to *Commerce Reports*, the general tariff is 2.50 bolivars over and above the rate which is paid over the State telegraph line for radiograms in Spanish. For messages in a foreign language, code, or cipher, double tariff is charged.

France.—NEW TELEGRAPH APPARATUS.—A new apparatus has been installed on the Brest-Casablanca submarine cable, 1,600 miles long, which increases the working of the cable by 80 per cent. Double Baudot-Picard apparatus serves simultaneously two transmitting and receiving sectors at a speed of 140 revolutions per minute, which corresponds to 5,600 words. This improvement is due to the work of M. Carrat, Inspector of Telegraphs in Paris.—*Reuter* (Paris).

Greenland.—TELEGRAPH SERVICE.—Since February 1st last, telegraph communication with Greenland has been available to the public. Messages are transmitted by cable to Iceland and thence by wireless.

Irish Free State.—AUTOMATIC TELEPHONY.—By the end of the present year the Irish Free State will have an automatic telephone service, with about 1,400 lines. The first exchange will be in Ship Street, Dublin, and the main framework has just been installed. The installation of the fittings has been begun by a British firm which has secured the contract, and some half-a-dozen Irishmen are studying the mechanism of automatic telephones in England.

The Telephone Service.—EASTBOURNE'S AUTOMATIC PLANT.—The whole of the Eastbourne Corporation's old common-battery manual system has been replaced by a Relay centralised automatic installation, which links up 50 stations, and the switchboard in the Town Hall is built on the expanding bookcase principle, so that additional units can be added from time to time without disturbing the existing service. Under the old manual scheme, a Town Hall call to any of the outlying stations had to go through the operator at the Town Hall, who passed it through the Eastbourne public exchange, which in turn passed is through the operator at the wanted station, taking from 30 to 50 seconds, or more, and each call cost 1½d. An automatic call goes through direct in three seconds, and costs nothing. Moreover, departmental service is available all night as well as all day, and public exchange service is available over certain night lines included in this new equipment. At present 19 departments are linked up under the new scheme. Other municipalities which have adopted the Relay scheme include Battersea, Birkenhead, Birmingham Estates, Burnley, Cardiff, Hampstead, Lambeth, Leyton, the Manchester Tramway Department, and Weston-super-Mare.

TAXI-CAB TELEPHONES.—Taxi-cab telephones that can only be used for incoming calls (from the hirer to the cab rank) are being installed in various parts of Liverpool, by arrangement between the Post Office and the Liverpool Motor Cab Trade Protection Society. Manchester and Bradford have made similar arrangements for the installation of such telephones, which have been tried successfully in London. In the box containing the telephone no means of calling the exchange is provided, and the door is automatically controlled, so that an ordinary call cannot be made from that end. When a hirer calls up the cab rank, a gong sounds inside the box, and the door opens to permit the driver to reply. The Society, which rents the telephones from the Post Office, intends to have a telephone installed on every rank in the city.

Radio Notes.

Australia.—NEW TRANSMITTER.—Transmission tests from the new station at Brisbane, Queensland, have been heard 1,400 miles away at Samarai, New Guinea. The station was using 5,000 watts.

LICENCES.—Following the reduction in the number of licences in Western Australia, it would appear from figures supplied by the Postal Department that the popularity of wireless is also steadily declining in New South Wales, whereas in Victoria it shows a tendency to increase. During the month ended February 28th, 1,694 new licences were

issued in New South Wales, as compared with 7,545 in Victoria. There were then 31,625 licences in New South Wales and 44,033 in Victoria, the total for the Commonwealth being 94,227. During the month 4,273 licences were cancelled in the Commonwealth; the number now in force per cent. of the population is 1.4 in New South Wales, 2.7 in Victoria, and 1.6 for the whole of Australia.—*Reuter's Trade Service* (Melbourne).

India.—BROADCASTING IN KARACHI.—The Karachi Radio Club has secured a transmitting set which has been loaned to it by the International Trading Co., agent of the Marconi Co. in Bombay. The municipality having granted permission, the transmitting set has been erected in Frere Hall, whence broadcasting will take place. Experiments made so far have given good results, and when sufficient progress has been achieved, it is proposed to arrange a regular broadcast programme.

Poland.—NEW STATION OPENED.—A new Polish broadcasting station was opened at Warsaw on April 18th, the speakers including Count Skrzynski, the Prime Minister, M. Grabski, Minister for Education, and M. Chamieo, president of the Polish Broadcasting Society.—*Reuter* (Warsaw).

Radio Slander.—FIRST ENGLISH CASE.—In the King's Bench Division, before Mr. Justice McCardie, a settlement was announced last week of the action, the first of its kind, brought against the British Broadcasting Co., Ltd., by Messrs. Williams & Norgate, Ltd., publishers. The B.B.C. expressed an apology and regret that the inaccurate statement in question should have been broadcast and would pay the firm an agreed sum in respect of damages and costs.

Spain.—PROPOSED NEW STATION.—The organising committee of the Radio Club of Alicante recently met at the Círculo Mercantil and discussed the constitution of a club and the opening of a broadcasting station. Another meeting will be held shortly to nominate the board of the club. The organising committee is of the opinion that a monthly subscription of two pesetas will cover the cost of the broadcasting.—*Reuter's Trade Service* (Madrid).

United States.—" AIR PIRACY " CLAIM.—It is reported that the Government has lost the " air piracy " case against the Zenith radio station, charged with broadcasting at illegal hours and on illegal wave lengths. The decision denies that Secretary Hoover has the power to regulate the air, and may result in chaos unless legislation by Congress is enacted.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Adwick-le-Street.—May 19th. Urban District Council. H.p. switchgear and cables, step-down transformers, l.p. distribution gear, pillars, cables, joint boxes, &c. (April 16th.)

Belgium.—ANTWERP.—May 28th. Municipal Council. Three electric cranes at the Entrepôt Royal. Particulars (Cahier des Charges) for 3½ fr. from Hotel de Ville.

Bristol.—May 13th. Electricity Department. One 7,000-kW turbo-alternator, with condensing plant and auxiliaries. (See this issue.)

Cheadle and Gatley.—May 3rd. Electricity Department. Electric lamps for street lighting for the year ending March 31st, 1927. Form of tender, &c., from Mr. R. W. Willis, engineer and manager, 37, High Street, Cheadle, Cheshire.

Doncaster.—May 4th. Electricity Department. One 1,000-kW motor converter and l.p. switchgear. (April 23rd.)

Dublin.—May 4th. Electricity and Public Lighting Department. E.h.p. and l.p. cables, cast-iron pillars, and stoneware troughing, section pillars, compound and other materials and accessories for one or two years. (April 23rd.)

Farnworth. — May 14th. Electricity Department. Cables, street-lighting pillars, pillars and boxes, cut-outs and meter boards, and meters. (See this issue.)

Glasgow.—May 6th. Electricity Department. L.p. cables, small i.r. insulated cables and flexibles, meters and carbons for 12 months. (April 23rd.)

Hull.—May 20th. Electricity Department. Underground cables. (See this issue.)

Ilford.—May 11th. Electricity Department. One 1,000-kW La Cour motor converter. (See this issue.)

India.—India Store Department. May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

May 11th. One 200-kW La Cour-type motor converter. (April 23rd.)

May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*

May 15th. Madras and Southern Mahratta Railway Co., Ltd. Telephone line material (comprising porcelain insulators, galvanised terminal irons, &c.), copper line wire (1,302 miles), copper binders, tapes, &c. (April 23rd.)

May 18th. Porcelain insulator cups. (See this issue.)

London.—LONDON COUNTY COUNCIL.—May 4th. Electric wiring and fittings at the Alton Street elementary school, Poplar, E. (April 16th.)

H.M. OFFICE OF WORKS.—May 7th. Steel conduits and fittings for electric wiring. (April 23rd.)

ST. MARYLEBONE.—May 5th. Electricity Department. L.p. and e.h.p. underground cables for 12 months. (April 23rd.)

METROPOLITAN ASYLUMS BOARD.—May 19th. Installation of electric cable, &c., for arc-light treatment apparatus. (See this issue.)

Manchester.—May 11th. Tramways Committee. Electric tramcar bodies, trucks, motors, and controllers. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

Middlesbrough.—Electricity Department. Extension of electricity supply distributors, total length approx. 1,000 yd. (See this issue.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*

WELLINGTON.—May 12th. Post and Telegraph Department. 18 switchboards.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

DUNEDIN.—May 28th. Otago Harbour Board. One portable electrically-driven cargo stacker.*

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (April 16th.)

Preston.—The Tramways Committee has decided to obtain quotations for the supply of a new double-deck tramcar and the adaptation of an existing one for use on the Ashton route.

Seaham Harbour.—May 5th. Urban District Council. Overhead l.p. pole line, h.p. cables, sub-station equipment, h.p. switchgear. Specifications (£2 2s.) from Mr. J. E. Favell, consulting engineer, 22, Oxford Street, Newcastle-on-Tyne.

South Africa.—JOHANNESBURG.—Municipal Council. 8 miles h.p. cable, 41 miles l.p. cable.*

Southern Rhodesia.—June 21st. Department of Posts and Telegraphs. Automatic telegraphs. Automatic telephone exchange for Salisbury. (April 23rd.)

Stockton-on-Tees.—May 10th. Electricity Department. Paper-insulated cables, a.c. meters, and house-service cut-outs. (See this issue.)

Turkey.—May 15th. Direction Générale des Postes et Télégraphes. 111,000 metres of 3, 7, 10 and 12 pair aerial telephone cable; 10,000 metres of 3, 7, 10 and 12 pair underground cable, with joint boxes and accessories.*

Walthamstow.—May 12th. Electricity Department. One 1,500-kW motor converter. (April 23rd.)

Warrington.—May 10th. Electricity Department. E.h.p. sub-station truck-type switchgear. (April 23rd.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines, e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (April 9th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—Postmaster-General's Department. Accepted :—

Night switching and dialling keys, ring-back keys, and speak-and-ring keys (£1,971).—Telephone Mfg. Co., Ltd.
Plug-seat switches (£782).—British L. M. Ericsson Mfg. Co., Ltd.
5 miles of cable, 12 pair (£1,187).—Hackbridge Cable Co., Ltd.

BRISBANE.—Postmaster-General's Department.

Four loading coil cases, containing 80 coils each (£1,104).—Standard Telephones & Cables (Aust.) Ltd.

SYDNEY.—New South Wales Railways.

21,000 yd. 66,000-V, single-core lead-covered cable (£10,944).—Enfield Cable Works (Aust.), Ltd.

—Tenders.

Barnes.—Urban Council. Accepted:—

Supplying and laying cables (£8,463).—Siemens Bros. & Co., Ltd.

Belfast.—Electricity Department. Accepted:—

Time switches for 12 months.—Venner Time Switches, Ltd.

Bexhill.—Electricity Committee. Recommended:—

500 yd. 3-core cable (£143).—Enfield Cable Works, Ltd.
Cable for switchboard extension (£121).—British Insulated Cables, Ltd.

Government Contracts.—The following Government contracts were placed during March, 1926:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Rewinding motor alternators.—Small Electric Motors, Ltd.
Aluminium sheets, &c.—British Aluminium Co., Ltd.
W./t. ammeters.—H. W. Sullivan, Ltd.
W./t. boards.—W. McGeoch & Co., Ltd.; Whipp & Bourne, Ltd.
Circuit boxes.—Basebe, Sadler & Co., Ltd.; Engineering & Lighting Equipment Co., Ltd.; Foster Engineering Co., Ltd.; General Electric Co., Ltd.; Hawkers, Ltd.; Player & Mitchell; Whipp & Bourne, Ltd.
Electric cable.—Anchor Cable Co., Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & India Rubber Works, Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. and Co., Ltd.
Cells.—Fuller's United Electric Works, Ltd.
Coils, w./t.—H. W. Sullivan, Ltd.
W./t. condensers.—Dubilier Condenser Co., Ltd.; Sparklets, Ltd.
Electric travelling crane.—J. Booth & Bros., Ltd.
Electric heating elements.—Credenda Conduits Co., Ltd.
W./t. frameworks.—Westminster Engineering Co., Ltd.
W./t. heterodyne units.—H. W. Sullivan, Ltd.
W./t. inductances.—H. W. Sullivan, Ltd.
Electric lamps.—Siemens & English Electric Lamp Co., Ltd.
W./t. masts.—C. F. Elwell.
Mica.—Mica & Micanite Supplies Co., Ltd.; Dacier, Ltd.; Micanite and Insulators Co., Ltd.; Mica Mfg. Co., Ltd.
W./t. motor alternators and motor generators.—Newton Bros. (Derby), Ltd.
Electric motors.—Brush Electrical Engineering Co., Ltd.
W./t. panels.—H. W. Sullivan, Ltd.
Automatic starters (w./t.).—Watford Electric Mfg. Co., Ltd.
Switchboard and switchgear.—Edison Swan Electric Co., Ltd.
Changeover switches.—General Electric Co., Ltd.
Tin wire.—C. Clifford & Son, Ltd.; British Insulated Cables, Ltd.
Valves.—Mullard Radio Valve Co., Ltd.
Valves and lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

WAR OFFICE.

W./t. valves.—British Thomson-Houston Co., Ltd.; A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

AIR MINISTRY.

8,000 inert batteries.—Edison Swan Electric Co., Ltd.
Cable and boxes (Karachi).—Standard Cables & Telephones, Ltd.
Motor alternator (Kidbrooke).—Electric Construction Co., Ltd.
Repair of magnetos.—British Thomson-Houston Co., Ltd.
W./t. mast stays.—Bullivant & Co., Ltd.
Transmitter and receiver.—Marconi's Wireless Telegraph Co., Ltd.

POST OFFICE.

Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.
Battery stores.—Accumulators of Woking, Ltd.; Alton Battery Co., Ltd.; D.P. Battery Co., Ltd.; Hart Accumulator Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Joint-box castings.—United Steel Co.'s, Ltd. (T. Butlin & Co.).
Testing and protective apparatus.—Automatic Telephone Mfg. Co., Ltd.; British Thomson-Houston Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.; Standard Telephones & Cables, Ltd.
Cords for telephones.—British Insulated Cables, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Fire Brick Co., Ltd.; Doulton & Co., Ltd.; Hepworth Iron Co., Ltd.; H. R. Mansfield, Ltd.; J. Oakes & Co. (Reddings Collieries), Ltd.; Oates & Green, Ltd.; Standard Brick & Terra Cotta Co., Ltd.; Sykes and Son.
Electric light fittings.—Cable Accessories Co., Ltd.
Hand lamps.—Cable Accessories Co., Ltd.
Lamps.—Edison Swan Electric Co., Ltd.
Insulating tape.—Connollys (Blackley), Ltd.
Replacing batteries (Manchester (Central) telephone exchange).—D. P. Battery Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—London-Dorking: Siemens Bros. & Co., Ltd. London-Welwyn: W. T. Henley's Telegraph Works Co., Ltd.
Electric lighting (Brighton new sorting office and telephone exchange).—A. Hawkins & Sons.
Radio station power plant (St. Albans).—British Thomson-Houston Co., Ltd.
Telephone exchange equipment.—Macclesfield: Standard Telephones and Cables, Ltd.; sub-contractors: Electric Construction Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. North, Leith, Birmingham (East): Standard Telephones & Cables, Ltd. Kelvin, Cheltenham, Ipswich, Torquay: Automatic Telephone Mfg. Co., Ltd. Southend (2nd relief): Siemens Bros. & Co., Ltd.; sub-contractors: English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Beauchief, Hereford: Siemens Bros. and Co., Ltd. Foleshill (Coventry): General Electric Co., Ltd.; sub-contractors: Crompton & Co., Ltd., for charging machines; Automatic Telephone Mfg. Co., Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Harrogate: General Electric Co., Ltd.; sub-contractors: Crompton & Co., Ltd., for machines; D. P. Battery Co., Ltd., for batteries. Clerkenwell: General Electric Co., Ltd.
Private branch exchange telephone equipment.—Motherwell County Hospital; Gaumont & Co., Ltd. (W.); Armitage & Rigby, Ltd. (Manchester); Ye Mecca, Ltd. (S.E.); Burnley Corporation; Shell-Mex, Ltd. (S.W.); A. Dunkelsbuhler & Co. (E.C.); Swan & Edgar, Ltd. (W.); Maypole Dairy Co., Ltd. (E.C.); Camberwell Board of Guardians (S.E.); T. Forman & Sons (Nottingham).—Relay Automatic Telephone Co., Ltd.

H.M. OFFICE OF WORKS.

Imperial Institute, S.W., wiring.—F. Troy & Co., Ltd.
Cable.—Lydbrook Cables, Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—British Insulated Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Standard Telephones & Cables, Ltd.; St. Helens Cable and Rubber Co., Ltd.
Copper wire, &c.—Shropshire Iron Co., Ltd.; R. Johnson, Clapham and Morris, Ltd.; Elliott's Metal Co., Ltd.
Electric portal cranes.—W. Arrol & Co., Ltd.; Wellman, Smith & Owen Engineering Corporation.
Electrical materials.—F. Smith & Co., Ltd.
Tubular poles.—Siemens Bros. & Co., Ltd.

Irish Free State.—DUBLIN.—The following contracts were placed by the Controller of Stores (Posts and Telegraphs) from February 23rd to March 22nd, 1926:—

Battery boxes, Leclanché.—G. Perry & Co., Ltd.
Broadcasting supply instruments.—Marconi Wireless Telegraph Co., Ltd.
Cable.—F. Routledge; Victor Zorn; Enfield Cable Works, Ltd.
Copper wire.—W. F. Dennis & Co.; Siemens-Schuckert (Ireland), Ltd.
Generators.—Sterling Telephone & Electric Co., Ltd.
Megger.—Evershed & Vignoles, Ltd.
Cable rings.—Standard Telephone & Cables, Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.
Switchboard parts.—Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; International Electric Co., Ltd.

London.—LONDON COUNTY COUNCIL.

Tram track rails (about 4,400 tons) for the next 12 months:—

Bolckow, Vaughan & Co., Ltd. (Accepted.)	**£46,607**
Cargo Fleet Iron Co., Ltd.	48,819
Alexr. McBean & Son (for Dorman, Long & Co., Ltd.) ...	50,415

20-V, 20-amp. accumulators.—Edison Swan Electric Co., Ltd.

Education Committee. (Accepted.)

Alterations to electric lighting, Shap Street school, Shoreditch (£226).—G. Keetch.

STEPNEY.—Electricity Supply Committee. Accepted:—

4 tons plumber's solder (£408).—G. W. Neale, Ltd.
12 feeder boxes and 12 sub-feeder boxes (£399).—British Insulated Cables, Ltd.
24 single feeder boxes (£150).—W. Lucy & Co., Ltd.
4 tons sheet lead (£175 10s.).—G. Farmiloe & Sons, Ltd.
100 tons pitch (£494).—Gas Light & Coke Co.

GREAT WESTERN RAILWAY.

Two 30 cwt. electric luggage lifts at Queen Street station, Cardiff, and an 8-cwt. electric lift at the west end of the general offices at Paddington.—Smith, Major & Stevens, Ltd.

Morley (Yorkshire).—

Electrical wiring, &c., municipal houses on Middleton Road estate (£341).—F. W. Rhodes.

Northampton.—Rural Council. Accepted:—

Wiring Council houses at Bugbrooke and Nether Heyford (£5 17s. 9d. per house).—Northampton Electric Light & Power Co., Ltd.

Peterborough.—Town Council. Accepted:—

Boiler plant (£34,190).—International Combustion, Ltd.
Pulverised fuel plant (£24,936).—Simon-Carves, Ltd.
—*Peterborough Standard.*

Preston.—Electricity Committee. Recommended:—

Cables (£6,633).—British Insulated Cables, Ltd.
Transformers.—English Electric Co., Ltd. (£1,226); Ferranti, Ltd. (£1,000).

Preston-Blackpool transmission line:—

45,000-V underground cable (£15,572).—W. T. Glover & Co., Ltd.
Transformers (£21,138).—English Electric Co., Ltd.
Switchgear (£3,807).—Metropolitan-Vickers Electrical Co., Ltd.
Overhead line in Longton area (£3,711).—Callender's Cable & Construction Co., Ltd.

Retford.—Town Council. Accepted:—

Generating plant (£12,020).—Electric Construction Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—

Replating the traction battery (£3,050, less allowance for old plates, £736).—Chloride Electrical Storage Co., Ltd.

Swansea.—Electricity Committee. Accepted:—

Oil purifier (£175).—Haslam & Stretton, Ltd.

Todmorden.—

Electric lighting installation at Todmorden Hall, Post Office.—B. Beattie.

Torquay.—Electricity Committee. Accepted:—

1,000-kVA, 3/2-phase transformer group (£832).—British Electric Transformer Co., Ltd.
Switchgear (£574).—British Thomson-Houston Co., Ltd.

Tynemouth.—Electricity Committee. Accepted:—

Cable.—Standard Telephones & Cables, Ltd. (£604); Macintosh Cable Co., Ltd. (£142 and £1,635).

Forthcoming Events.

Royal Institution.—Friday, April 30th. At 21, Albemarle Street, W.1. At 9 p.m. Lecture on "Wireless in the Empire," by Dr. W. H. Eccles. Thursday, May 6th. At 5.15 p.m. Lecture on "The Imperfect Crystallisation of Common Things." by Sir William Bragg. (Lecture II.)

Junior Institution of Engineers.—Friday, April 30th. At the Royal United Service Institution, Whitehall. At 7.30 p.m. Gustave Canet Memorial Lecture, "Air Transport," by Air Vice-Marshal Sir W. Sefton Brancker. Friday, May 7th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Distortion in Wireless Reception," by Mr. A. V. Ballhatchet.

Institution of Engineers-in-Charge (Inc.).—Friday, April 30th. At the Holborn Restaurant, London. At 6 p.m. Annual dinner.

Institution of Electrical Engineers (Western Centre).—Monday, May 3rd. At the Chamber of Commerce, Swansea. At 6 p.m. Paper on "An All-Electric House," by Dr. S. P. Smith.

(Wireless Section).—Wednesday, May 5th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Lateral Deviation of Wireless Waves and the Development of an Accurate Direction-Finder," by Messrs. R. L. Smith and R. H. Barfield.

(Scottish Centre).—Friday, April 30th. At the Y.M.C.A. Hall, Constitution Road, Dundee. At 7.30 p.m. Lecture on "The Past, Present, and Future Development of Wireless Telephony," by Capt. P. P. Eckersley. Saturday, May 1st. Excursion to St. Andrews.

Society of Engineers.—Monday, May 3rd. At the Science Museum, South Kensington, S.W. At 5.30 p.m. Paper on "Landmarks in the History of Prime Movers," by Mr. H. W. Dickinson.

National Association of Supervising Electricians.—Tuesday, May 4th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. W. E. Highfield Shield Competition.

Roentgen Society.—Tuesday, May 4th. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary meeting.

Edinburgh Electrical Society.—Wednesday, May 5th. At the Royal Scottish Society of Arts, 117, George Street. At 8 p.m. Business meeting.

Royal Society of Arts.—Wednesday, May 5th. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "Radio: Its Past, Present, and Future," by Mr. C. F. Elwell.

Electrical Association for Women.—Friday, May 7th. At the Criterion Restaurant, Piccadilly, W. At 1 p.m. Luncheon.

(Manchester District Branch).—Wednesday, May 5th. At the Lesser Free Trade Hall, Manchester. At 7.30 p.m. Public meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 8th. At Brecon. Annual meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

COLERIDGE electric irons.

Notes.

The Burgh of Hamilton Vacancy.—In our last issue in our "Personal" column we reported, on the authority of our Glasgow correspondent, that "Mr. W. J. Cooper, acting electrical engineer at Hamilton Electricity Works, has been appointed electrical engineer for the Burgh of Hamilton." In our advertisement pages of the same issue we published the Town Council's invitation for applications for the appointment. We subsequently received a communication from the Town Clerk of Hamilton informing us that the "Personal" column statement was incorrect, and had caused inconvenience to applicants. Further investigation shows the facts of the situation to be as follows:—The Town Council Electric Lighting Committee unanimously agreed to recommend that Mr. W. J. Cooper, at present acting electrical engineer, be appointed electrical engineer for the burgh. When the recommendation came before the Town Council, there was an amendment that the Council advertise for an engineer. The voting was six for the recommendation and six for the amendment. The Provost gave his casting vote for the amendment, and it was therefore agreed to advertise.

In the absence of the exact details, our correspondent accepted as authentic a report published in Glasgow. We have to express our regret to those concerned for any inconvenience to which they have been put in connection with the matter.

The Electricity (Supply) Bill.—This Bill came before a Standing Committee of the House of Commons on Tuesday last. Criticism was directed against the proposed Central Board, which, Sir Joseph Hall suggested, would in effect be merged in the Electricity Commission. Sir Charles Wilson considered that there was no need for such a board, as the Electricity Commissioners were quite competent to accomplish the aims of the Bill. Mr. Wallhead protested against the subjugation of efficient municipal undertakings to the Board.

A report of the proceedings will appear in our next issue.

Stage Lighting.—A discussion on this subject took place at the meeting of the Illuminating Engineering Society on March 30th, which was held at the E.L.M.A. Lighting Service Bureau. Mr. J. W. T. Walsh presided. Mr. H. Lester Groom, who opened the discussion by presenting a paper, illustrated by slides and exhibits of apparatus, pointed out that lighting on the stage was now called upon to discharge functions not associated with it in the past. It did not merely serve to permit the spectator to follow the play, but also enabled certain mental effects to be created, so that it reinforced and supplemented the action. In this connection he quoted from Kenneth McGowan's book on "Continental Stage Craft." The aim of stage lighting is to provide light of any intensity, hue and tint, just when and where it may be required. For this purpose a great variety of lighting implements is needed.

Mr. Groom then proceeded to describe and illustrate the action of footlights, battens or border lights, spot lights and portable units, and the cyclorama. The most important development of recent years has been the effort to obtain a representation of realistic and natural atmospheric effects on the stage. For this purpose cycloramas are extensively used abroad, and consist of two types, a solid "sky dome" consisting of a plaster surface supported by a metal framework, and a movable canvas "artificial horizon" cloth running on a curved rail, which can be rolled up out of the way when not required. The use of this device involves some modfication in the lighting of the acting area, as care has to be taken to prevent light from battens, footlights, &c., striking the canvas. Special floods called "acting area floodlights" are used and are dimmed down sufficiently to avoid interference with the lighting of the cyclorama. Details of cyclorama lighting and panorama and cloud-forming apparatus were given, and the arrangement of the battery of colour-elements was described. Taking the complete range of conditions from a small theatre to a large opera house, the power consumption for this equipment may range from 20 to 100 kW.

Mr. Groom also discussed the choice of dimmers, on which successful lighting largely depends, and emphasised the importance of the whole stage lighting being controlled from one central position. In the final section of the paper a reference to the possibilities of colour on the stage was made. The author explained how modifications in the colour of light, falling on a painted background, may entirely change the appearance of scenery; this principle has been applied to produce ingenious transformations in the garments of dancers; in the same way fluorescence of garments impregnated with special dyes, under the action of ultra-violet light, has been used.

There is now a distinct tendency for kinema theatres to combine the exhibition of films with displays of a more or less theatrical character and some of the latest theatres, especially in Germany, have been fitted with complete stage-lighting equipment. The cyclorama apparatus may form a valuable auxiliary in kinema displays, provided sufficient depth of stage is allowed to give a proper perspective. At the recently opened Plaza Theatre in London a completely equipped stage, including the cyclorama, has been provided.

In conclusion Mr. Groom remarked that the stage lighting of the future would require the co-operation of the scenic artist, the producer, and the stage-lighting expert.

The discussion was opened by Mr. L. G. Applebee, who exhibited a variety of stage-lighting units and lantern slides illustrating the application of flood lighting at the Searchlight Tattoo at Wembley. An effective demonstration was also given of projecting apparatus enabling the motion of waves of the sea, falling snow, and fire and smoke to be imitated.

Local Society.—A meeting of the Birmingham Electric Club took place on April 23rd, when Mr. C. G. McDonald opened a discussion on "Regulations for the Electric Equipment of Buildings." The summer outing of the club is arranged for May 14th to the English Electric Company's works at Preston.

Electro-Farming Conference.—Under the auspices of the British Electrical Development Association Agricultural Sub-Committee, the second British Electro-Farming Conference will take place on July 8th in the Members' Tent on the Showground of the Royal Agricultural Society at Reading, by the courtesy of the Council of the Royal Agricultural Society. Further details of the Conference will be issued later.

The L.C.C.'s Annual Estimates.—The estimates for the year 1926-27 were to be submitted to the London County Council at its meeting on Tuesday last. The agenda for the meeting contained a number of amendments to items in the estimates, including one providing for the operation of petrol and trolley omnibuses by the Council, and another to empower the Council to own and operate tube railways, and to acquire the existing underground railways.

Extensions at Wallasey.—The opening of the new extensions to the Wallasey Corporation power station was performed on April 21st by the Mayoress, Mrs. J. W. Holdsworth, in the presence of a large company of electrical engineers and local representatives, and the event was celebrated by an official luncheon after the ceremony.

The Mayor of Wallasey, Alderman J. W. Holdsworth, J.P., in proposing "The Electricity Undertaking, Engineer and Staff," said that Wallasey inaugurated her electricity supply in 1897, from which time it had proved itself an asset both from the point of view of finance and service. A matter of £120,000 had been contributed to the relief of rates. The Corporation was proud of its electricity undertaking, and claimed that it was second to none in the country. He paid a tribute to Mr. B. T. Hawkins, the borough electrical engineer, and his staff. New consumers were being connected at the rate of 1,000 per annum in spite of the zeal and energy of the Corporation Gas Committee. Their immediate neighbour, Birkenhead, was drawing large supplies of electricity from Wallasey, and in return Wallasey was taking large supplies of Birkenhead water.

Mr. E. M. Hollingsworth, M.I.M.E., M.I.E.E., said it was some years since he had visited the Wallasey undertaking, whose progress had been incredibly rapid. Wallasey was in the forefront of electricity supply. Its record as regarded thermal efficiency, low cost of production, average selling prices, and reliability of supply was outstanding. He had burned midnight oil in trying to understand the Electricity Supply Bill, particularly Clause 30, which referred to the lopping of trees, &c. In going through the Wallasey power station his sympathy with the promoters of the Bill was intensified. If there were more stations like Wallasey's the problem of the Government would be simple.

Alderman E. G. Parkinson, J.P., proposed "Neighbouring Electricity Undertakings." Electricity, he said, was rapidly becoming a marked feature in the life of this country. The electrical industry was still in its youth, and almost every day there seemed to be something fresh to learn.

Councillor G. P. Dennis, chairman of the Birkenhead Electricity Committee, urged the need for co-ordination in the matter of electricity supplies between the Merseyside boroughs. If it were possible to get the electrical engineers of Liverpool, Birkenhead, and Wallasey together, to draw up a scheme for the electrical development of the Merseyside towns it would be of advantage to the whole district.

Councillor J. Hughes complimented the contractors and Mr. A. T. Brotherton, Brush Electrical Engineering Co., Ltd., and Mr. W. Bayliss, Messrs. Babcock & Wilcox, Ltd., made suitable replies.

Councillor J. McMillan, M.B., said that the scheme which had been consummated that day had cost over £100,000. The financial policy of the Electricity Department was to build up reserve funds so that no matter what the Government decided to do, Wallasey would always have a financially sound electricity undertaking.

Councillor J. Hughes said that in 1913 each kWh generated at the Wallasey undertaking required 7¼ lb. of fuel; in 1918, when the new station was opened, the fuel consumption was 3.89 lb., and to-day it was 2.7 lb. They had over 10,000 consumers. The capital expenditure in 1913 was £123,000, and in

1926 £453,748. The gross revenue had increased from £32,517 to £124,000 within the same period.

On behalf of the electrical contractors, Mr. Brotherton then presented a silver salver, suitably inscribed, to the chairman of the Electricity Committee and also to the Mayoress. The members of the Council also presented a roll-top desk and a bookcase to the chairman of the Electricity Committee, to mark the occasion of his recent marriage.

After the luncheon the visitors made a motor tour round the northern extremity of the Wirral Peninsula, returning via Birkenhead. The extensions include two 35,000-lb. Babcock & Wilcox boilers, a 5,000-kW Brush-Ljungström turbo-alternator, an electrically remote-controlled switchboard, by the Metropolitan-Vickers Electrical Co., Ltd., and coal- and ash-handling plant and auxiliaries.

Italian Railway Electrification.—In connection with the recent decision of the "Ferrovia Nord" (Italy) to electrify portions of its suburban railway system between Milan and Saranno and between Bovisa and Meda, it is understood that the Brown Boveri organisation has secured the contract for the electrical equipment "against very strong competition." At present the work to be carried out consists of:—(1) The electrical equipment for the sub-station at Novate, consisting of three 2,000-kW sets of power rectifier plant operating at a d.c. pressure of 3,000 volts, the step-down being from three-phase, 22,000 volts at 42 periods. (2) The electrical equipment of eight four-axle motor coaches, each provided with four 184-h.p. (one hour rating) motors, operating two in series across 3,000 volts. (3) The electrical equipment of eight trailer coaches, provided with drivers' cabs. A train will generally consist of a motor coach at one end, with two or three ordinary trailers according to requirements, and a trailer with a driver's cab at the other end. Control will thereby be obtained at both ends without the necessity of using two motor coaches. The normal speed of the trains will be about 33.5 m.p.h., and the maximum speed about 62 m.p.h. The latest improvements with regard to electro-pneumatic safety control will be embodied, being such that in the event of an accident to the driver the train will be automatically brought to a standstill. The safety arrangements operate in such a manner that a time interval must elapse before they come into operation; that is to say, they will only operate after a certain distance has been covered, so that if the driver leaves his position for a few moments the train will not unnecessarily be stopped. An interesting feature is the fact that high-power rectifiers are being again used for the conversion, while a further point is that the control, as well as the arrangement of the trailers, is not only suitable for suburban service, but also for underground conditions. The electro-pneumatic control referred to can be applied equally well for cases where other systems are at present in use.

Fatalities.—An inquest was held at Torquay on Herbert Gurney (14), an apprentice to Mr. S. E. Hunt, electrician, 8, Torwood Street, Torquay, who received a fatal electric shock in the basement of his employer's premises. It appears that an old flexible cord which was supplying a light in the cellar from the shop above, was making contact with tubing stored in that department, and that the boy obtained the shock from contact with the tubing. The cellar was damp. Mr. H. F. G. Woods, the Torquay Borough Electrical Engineer, said it was obvious that the flex produced had been badly rubbed in two places, and that if it became entangled with the tubing the whole of the latter would become alive. It was stated by two doctors that the lad was in a somewhat abnormal condition and that it was due to that fact that a shock at 200 volts had killed him. In recording a verdict of "Accidental Death," the Coroner said he could not shut his eyes to the fact that there had been thoughtlessness, and for all he knew a jury might have taken a more serious view of it. He hoped those who read the facts in the papers would take notice of them and adopt proper precautions and see that these thoughtless things were not done. The Coroner thanked Mr. Hunt for doing what he could for the boy.

While working on the construction of a concrete bed on the City and South London Railway extension to Morden at Balham, on April 26th, Edward Cox slipped and touched the "live" cable, receiving a fatal shock.

The Illuminating Engineering Society (U.S.A.).—The twentieth annual convention of the Illuminating Engineering Society will be held at Spring Lake, N.J., from September 7th to 10th, inclusive, with headquarters at the Essex and Sussex Hotel, a short trip from New York and Philadelphia. A well-rounded papers programme is being prepared, with special features showing the developments in specific fields which have taken place during the twenty years of existence of the Society. Special and unique features are also being planned for the entertainment programme.

Educational.—THE POLYTECHNIC, REGENT STREET, W.—Electrical Engineering Department, Wireless, and High-frequency Section.—A special course of six lectures on "The Thermionic Valve and its uses in Wireless Circuits" will be delivered by Mr. W. H. Date, on Wednesdays, commencing May 12th, from 6.30 to 8.30 p.m. Fee for the course, 7s. 6d. Particulars, &c., from the Director of Education.

A special course of six lectures on "Electrical Engineering Economics" will be given on Thursdays, commencing May 13th, by Mr. D. J. Bolton. Fee for the course, 7s. 6d.

BOROUGH POLYTECHNIC INSTITUTE, BOROUGH ROAD, S.E.—Short courses of lectures and laboratory work on electrical engineering, including alternating currents, automatic telephony, cable jointing, and physics, commence on May 3rd. Full particulars can be obtained from Mr. J. W. Bispham, the Principal. (See our advertisement pages to-day.)

Electrical Association for Women.—In connection with the newly-formed Manchester District Branch of the above Association, a public meeting will be held in the Lesser Free Trade Hall, Manchester, on May 5th, when the chair will be taken by Mr. B. Mouat Jones, D.S.O., Principal of the College of Technology. The meeting will be addressed by Miss Ellen Wilkinson, M.P., President of the Branch, Mr. J. A. Roberts, M.I.E.E., and Miss C. Haslett, Director of the Association. Further particulars with regard to the meeting can be obtained from the local Hon. Secretary, Miss G. L. Entwistle, A.M.I.E.E., c/o the Motor Department, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.

Appointments Vacant.—Telegraph foreman (£400), for the Government of Gold Coast. Plumber-jointer, for the Stepney Borough Council Electricity Department. Assistant mains engineer (£208 to £260), for the Gillingham Borough Council Electric Lighting Department. Electrical engineers (several), for the Calcutta Electric Supply Corporation, Ltd. Switchgear engineer (£362), for the Hackney Corporation Electricity Department. Showroom manager (£314), for the Borough of Burnley Electricity Department. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.—The annual general meeting of the above centre was held on April 19th, when the officers and Committee for the 1926-27 session were appointed. The new chairman will be Mr. P. J. Robinson; vice-chairmen, Prof. F. J. Teago, D.Sc., and Mr. S. E. Britton; hon. sec. and treasurer, Mr. Oscar C. Waygood. After the meeting, Prof. S. P. Smith read his paper on "An All Electric House," which was followed by a very interesting discussion.

SOUTH MIDLAND CENTRE.—The annual general meeting of the above centre was held on April 28th, when the Report of the Committee was presented. The total membership of the centre at March 31st last was 1,018, representing an increase of 33 on the number for the previous year.

NORTH WESTERN AND MERSEY AND NORTH WALES (LIVERPOOL) CENTRES.—The Committees of the above centres have arranged for a re-union to be held at Chester on May 12th. The programme includes visits to Poole Bank Farm, Tarvin, and Yew-tree Farm Sealand (both equipped with electrical appliances), the works of Brookhirst Switchgear, Ltd., and the Chester Corporation hydro-electric station.

Institute of Physics.—PHYSICS IN INDUSTRY.—The tenth lecture of this series, which is being given under the auspices of the Institute of Physics, will be delivered by Mr. H. E. Wimperis, Director of Scientific Research, Air Ministry, and will deal with "The Relationship of Physics to Aeronautical Research." The lecture, which will be open to the public, will be given in the Physics Theatre, Royal College of Science, South Kensington, on May 11th, at 5.30 p.m., and the chair will be taken by Sir William Bragg, President of the Institute.

Junior Institution of Engineers.—At the question and discussion evening on Friday last, the opportunity was taken of discussing further Mr. Allison's lecture of the previous week on the electrical equipment of automobiles. Points were raised as to the standardisation of voltage, the output of magnetos, and the manufacture and use of automobile lamps. Other topics also received attention.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

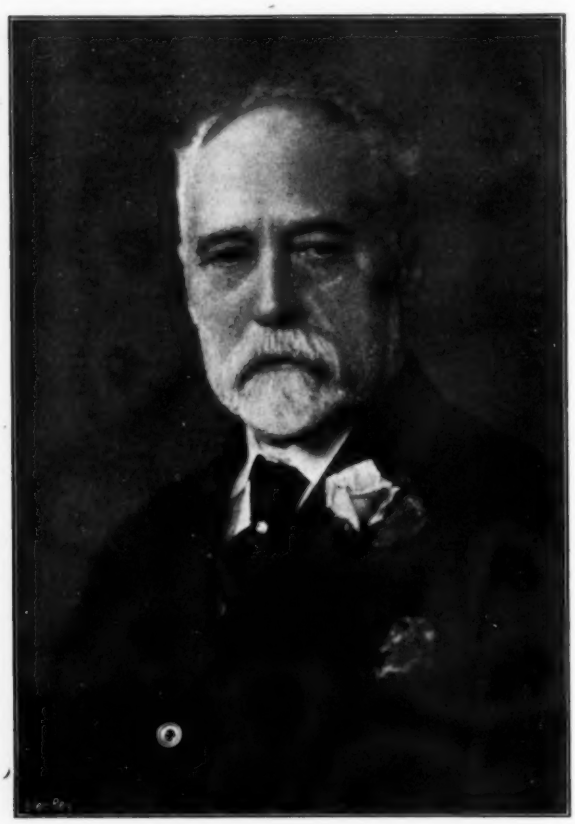
It is reported that Mr. G. F. MOLLER, M.I.E.E., general manager of the Lanarkshire Tramways Company, Ltd., has resigned his position.

Mr. M. EPSTEIN, M.A., Ph.D., was elected to succeed Mr. Oppenheimer as chairman and managing director of the Phœnix Telephone & Electric Works, Ltd. Dr. Epstein joined the board in May, 1922, and during Mr. Oppenheimer's illness has acted as deputy managing director. Mr. EDWIN J. REID, M.I.E.E., another of the directors, has been appointed technical manager. There will be no change of policy in connection with the business.

Mr. J. ROBERTS, who has been in charge of the power station at the Port of Richborough, has been appointed power-station superintendent to Messrs. Lake & Elliot, Braintree, who supply electricity in bulk to Braintree and Bocking.

Herr GEORG SCHMIDT, the director of the telegraph and telephone division of the Siemens & Halske Co., Berlin, recently celebrated the completion of forty years' service with the company.

We wonder how many men there are amongst us to-day who can look back upon a record of nearly forty-two years' active connection with British electrical manufacturing in a business operating under their own name. Mr. Francis Henry Nalder, managing director and chairman of Nalder Bros. & Thompson, Ltd., who is still taking an active part in the operations of that concern, of the latest extension of whose works we gave



F. A. Swaine] [*London.*

Mr. F. H. Nalder.

an illustrated account in the Electrical Review for February 5th, 1926, dates his first productive electrical work from the end of the year 1884, when he started in business with his brother, Mr. H. Nalder. The firm thus founded opened a small works in Brentford early in 1885, and an extension soon followed. After more than forty-one years, the name Nalder still stands at the head of an extending business as our recent article indicated. Mr. Nalder was born at Reigate in May, 1859, so that notwithstanding his lengthy practical experience, he is still, as we like to regard years, comparatively young, for has not our old friend, George Offor, just passed the 99th mark? After education in England and Germany, Mr. Nalder first had four years' experience in a London merchant's office, from which he branched off to the School of Telegraphy and Electrical Engineering at Hanover Square, and subsequently to Finsbury Technical College. Then in 1884 came the Brentford development already mentioned. Two years later he was joined in partnership by Mr. C. W. S. Crawley; the works were then moved to Horseferry Road, Westminster, and extended operations were entered upon in the following year, 1887 when Mr. Alfred Soames became a partner in the firm, and the name was: Nalder Bros. & Co. Once again larger works became necessary, and the records show that in 1890 Red Lion Street, Clerkenwell, was the firm's centre of operations. The spirit of enterprise with which Mr. F. H. Nalder was possessed in those early years is evidenced by the fact that he paid four visits to the United States and Canada in the period 1891-1893, studying the course of electrical progress and development there. Other visits to the States took place in 1901 and 1904 respectively, the latter on the occasion of the International Electrotechnical Congress. When in 1896 circumstances led to the division of the business, Mr. Nalder went into partnership with the late Mr. Ernest Thompson, and established the firm of Nalder Bros. & Thompson, which devoted itself to the manufacture of every description of instrument that is employed on a switchboard, also switchgear, automatic switches, &c., and occupied works at 34, Queen Street, E.C. Still progressing, additional works had to be taken, and these, in 1899, were opened at Dalston, the business being at the same time converted into a private limited company. From this change we may take a long jump to 1914, when the Queen Street lease came to an end, and removal to the present headquarters, 97a, Dalston Lane, was undertaken, the Kingsland Green works being still retained. The larger scale operations that thus became possible helped the company to handle the demands which arose out of the requirements of the nation while at war. Before touching upon other matters, it may be remarked that the business of Nalder Bros. & Thompson, Ltd., is still Mr. Nalder's principal interest—and indeed his hobby too—for he is as alert as ever regarding new methods of manufacture, development work, and the getting of new business. It is interesting to record that his second son, Mr. D. W. Nalder, is engaged in the company's works. Personal interests have not prevented Mr. Nalder from devoting attention to the larger interests of the industry as a whole, for, as would be seen from a statement made here in another connection last week, he was one of the first members of the National Electrical Manufacturers' Association when it was born in 1905. When some six years later that organisation was put on to a larger basis and its name was changed to the British Electrical and Allied Manufacturers' Association, Mr. Nalder was appointed its first chairman, and he has been on the Council of the Association ever since, with the exception of one year during the war. He is a Governor of Battersea Polytechnic, of the Hackney Technical Institute, and of the Devas Institute; also chairman of Oertlings, Ltd., chemical balance and scientific instrument makers. He was elected as an Associate Member to the Council of the Institution of Electrical Engineers in 1890, during the presidency of the late Dr. John Hopkinson. While he is therefore one of the oldest members of the premier professional body, he also showed his appreciation of movements of a modern character on the social side of the profession a few years ago by becoming an original member of the Engineers' Club. He has been a prominent Freemason for many years.

Messrs. H. A. Lingard and Mr. W. E. Rawlinson, of the International General Electric Co., were among the passengers sailing by the Cunard liner *Aquitania* from Southampton to New York on April 24th.

Mr. Stanley H. Chatterley, late Midlands district manager for the Sterling Telephone & Electric Co., Ltd., has been appointed general manager of Cantie Switches, Ltd., Nottingham, an associated company of Brookhirst Switchgear, Ltd.

The Electric Heating Co., of George Street, Croydon, has recently appointed Mr. H. J. Dean Osgood to take over the entire control of the works. Mr. Osgood was formerly with the Dowsing Radiant Heat Co. and Messrs. H. W. Sullivan and Co.

Obituary.—Sir Henry Mance.—It is with deep regret that we have to record the death of Sir Henry C. Mance, C.I.E., LL.D. The sad event was mentioned by the president at last week's meeting of the Institution of Electrical Engineers before the delivery of the Kelvin Lecture. Members stood in silence as a mark of respect for a distinguished past-president and one of the oldest of their fellow-members. In 1873 he joined as an Associate,

Elliott & Fry] [*London.*

The late Sir Henry Mance.

becoming a full member in 1877 and president in 1897. Sir Henry passed away on Wednesday, April 21st, and the funeral took place on Saturday at Oxford. Sir Henry Christopher Mance was born at Brockley in 1840, and was therefore in his 86th year. After being privately educated, he entered the service of the Electric & International Telegraph Company at the age of 18, and in 1863 he joined the Persian Gulf Tele-

graph Expedition, which was responsible for establishing telegraphic communication between England and India. Three years later he was appointed superintendent of the Persian Gulf section of the system, and had charge of various cables and some hundreds of miles of overhead line from Karachi to the Persian Gulf. In 1879 he was appointed engineer and electrician of the line, and he held that post until he retired from the service in 1885, when he received the honour of knighthood. In his "Narrative of the Formation and Development of Telegraphic Communication Between England and India," which he entitled "Telegraph and Travel," and published in 1874, Colonel Sir Frederick John Goldsmid records the laying of the cable from Jask to Bushar, and, amongst others, favourably mentions the work of Mr. Mance, one of the superintendents. This cable was laid in 1869. Perhaps Sir Henry's most notable contribution in the form of scientific inventions was the heliograph, which was produced in 1869, and demonstrated its great value in many military campaigns. For his services in this connection he was created a Companion of the Indian Empire in 1883. But he made numerous other contributions in the shape of electrical discoveries and inventions, including a method of locating faults in ocean cables, a method of testing the internal resistance of electric batteries, &c. During his service in the East he was for a time traffic manager, was responsible for cable-repairing expeditions, and for the erection of a factory at Karachi for the manufacture of telegraph cable. He contributed a number of papers to the *Proceedings* of the Society of Telegraph Engineers on subjects connected with telegraphy and telegraphic apparatus and testing, and for one of these papers he was awarded the Paris Exhibition Premium in 1884. He was a member of the Institution of Civil Engineers and of the Physical Society. After his retirement from the telegraphic service in India he devoted his experience and attention to various electrical and other undertakings. He was the founder of the Oxford Electric Co., Ltd., and chairman of the board until his death. He was also a director, and for some time chairman, of the Electrical Construction Co., Ltd., and was on the board of the West African Telegraph Co., Ltd. He was also for many years chairman of that very successful manufacturing enterprise—Messrs. Davis & Timmins, Ltd., to whom we are indebted for the loan of the very striking and life-like photograph from which the accompanying picture has been reproduced. Of Sir Henry's three sons, one—the eldest—Brigadier-General Harry Osborne Mance, C.B., C.M.G., D.S.O., was Director of Railways, Light Railways and Roads at the War Office from 1916 to 1920.

At the funeral at Oxford on Saturday, the Institution of Electrical Engineers was represented by Mr. R. A. Chattock (president), Mr. R. W. Paul (member of Council), and Mr. R. H. Tree (chief clerk).

MR. H. H. MARKHAM.—We regret to record that Mr. Herbert H. Markham passed away on April 17th at the age of 48 years. Mr. Markham joined the Western Electric Co., Ltd. (now Standard Telephones & Cables, Ltd.), in 1911, and was appointed manager of its Manchester branch, subsequently occupying similar positions at Birmingham and London. In 1921 he made an extended tour through Africa for the company, and in 1925 was appointed sales manager of the Calcutta office. Unfortunately, he was struck down with malaria, which necessitated his return to England in February of this year. Previous to his connection with the Western Electric Co., Mr. Markham was in the service of Messrs. Johnson & Phillips, Ltd., and the Sturtevant Engineering Co. He was a Freemason, being a member of the Kelvin Lodge and Kelvin Mark Lodge. He passed away in his sleep, the cause of death being heart failure due to enlarged heart weakened by malaria and rheumatic fever.

LORD STUART WORTLEY.—Lord Stuart Wortley, whose death at the age of 74 occurred on Saturday last, had long been connected with the London tube railway service. He was a director of the City & South London Railway Co., and of the London & Suburban Traction Co., also deputy chairman of the Underground Electric Railways Co., of London.

MR. S. GREEN.—The death occurred recently of Mr. S. Green, a director of the Clowne Electric Light Company.

Will.—The late Mr. WILLIAM TAYLOR GREEN, of the Leeds Corporation Electricity Department, left £3,970.

New Companies Registered.

J. P. Castle & Co., Ltd. (213,307).—Private company. Registered April 20th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with J. P. Castle, and to carry on the business of electrical and mechanical engineers as carried on by him at 40, Chancery Lane, W.C. The first directors are:—J. P. Castle, Sepham Farm House, Shoreham, Kent, engineer; Mrs. K. S. Castle, Sepham Farm House, Shoreham, Kent; J. L. Girling, Whitehouse, Felixstowe, engineer. Qualification, £10. Remuneration: 10 guineas each per annum (chairman, 15 guineas). Solicitors: Johnson and Johnson, Cromwell House, Fulwood Place, W.C.1. Registered office: 72, Shoe Lane, E.C.4.

Handcross Electricity Co., Ltd. (213,247).—Private company. Registered April 17th. Capital, £10,000 in £1 shares. Objects:—To carry on the business indicated by the title. The first directors are:—J. R. Warren, Handcross Park, Handcross; A. F. Page, M.R.C.S. (Eng.), L.R.C.P. (Lond.), The Red House, Handcross; E. S. Hibbs, Casterbridge, Handcross; D. Tulley, The Post Office, Handcross; G. Broadbridge, High Street, Handcross. Qualification, 50 shares. Remuneration as fixed by the company. Secretary: W. H. Hogger. Solicitor: R. S. Ross, Horley, Surrey. Registered office: The Post Office, High Street, Handcross, Sussex.

Official Returns of Electrical Companies.

Sylvex, Ltd.—Debenture dated April 12th, 1926, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Wolsey, 29, Gloucester Road, N.4.

Radio Communication Co., Ltd.—Satisfaction in full on April 14th, 1926, of debentures, authorised February 23rd, 1923, securing in the aggregate £100,000.

H. E. Davis, Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C., was appointed receiver and manager on April 12th, 1926, under powers contained in debenture dated December 2nd, 1924.

Builth Wells Electric Supply Co., Ltd.—Particulars filed of £2,500 debentures, authorised September 4th, 1925, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,875 (on April 1st, 1926).

Dunstable Central Motor and Electrical Co., Ltd.—Debenture dated March 25th, 1926, to secure £300 and such further sums not exceeding £100 as the lender may between the said date and March 30th, 1930, be called upon to pay to Lloyd's Bank, Ltd., under a guarantee, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. E. McCabe, 8/9, Byward Street, E.C.

T. W. Jefferson, Ltd.—H. W. Bowler, of 30, North John Street, Liverpool, C.A., was appointed receiver and manager on April 12th, 1926, under powers contained in debentures created June 30th, 1922.

Reading Electric Supply Co., Ltd.—Particulars filed of £150,000 6 per cent. first mortgage debenture stock, redeemable at a premium, authorised January 7th, and covered by trust deed dated March 4th, 1926, the whole amount being now issued. The company has power to issue further stock not exceeding the amount of the share capital of the company for the time being paid or credited as paid up. Property charged: Land, premises, plant, &c., at Reading and the company's undertaking and property, present and future, including uncalled capital. Trustees: British Trusts Association, Ltd., 32, Bishopsgate, E.C.

Satisfaction in full on March 30th, 1926, of trust deed dated December 31st, 1921, securing £100,000.

British Insulated Cables, Ltd.—Satisfaction (a) to the extent of £200,000 (being amount issued) on various dates on and before February 5th, 1926, of mortgage or charge dated November 28th, 1910, securing £500,000 5 per cent. mortgage debenture stock, and (b) in full on various dates on and before April 8th, 1926, of mortgage or charge securing an issue of 4½ per cent. debenture stock dated July 22nd, 1901, as modified by indentures dated May 21st, 1902, September 27th, 1905, and November 28th, 1910, securing £500,000.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Satisfaction in full on December 30th, 1925, of charges, &c., dated November 28th, 1907, to December 15th, 1921, securing £80,494 7s. 7d.

City Notes.

Reports and Meetings of Electrical Companies. Dividend Results, &c.

English Electric Co., Ltd.

The annual meeting of the company was held on April 21st, under the chairmanship of Sir Charles E. Ellis, G.B.E. In moving the adoption of the report (*vide* ELEC. REV., April 16th, p. 630), the chairman said that for the first time they had prepared a consolidated balance sheet, embracing the accounts of all their subsidiary companies, and incorporating those of Willans & Robinson, Ltd., of which company they owned the entire share capital. It was their present intention that that company should remain a separate entity. The item in the balance sheet, "Sundry creditors and credit balances (including secured bank loans)," amounted to £1,296,007. As against this "Debtors and debit balances" amounted to £1,752,956, and the "Stocks and work-in-progress", to £1,353,278, or a total of £3,106,234, leaving the substantial surplus of over £1,800,000. Referring to the item "Investments, £424,585," the chairman said that in the amalgamation of the accounts they had found it necessary to provide from certain reserves for a depreciation of nearly £80,000 from the investment account. In common with other large post-war amalgamations, they had found that among the various classes of business which their constituent companies had developed there were some which were only very indirectly related to the main business of the English Electric Company, formed as it was to specialise almost entirely on electrical and mechanical engineering products. They had therefore decided to dispose of those extraneous businesses, but unfortunately two of those concerns had produced such unsatisfactory trading results as to cause a capital loss which was responsible for the major portion of the depreciation referred to. The profit and loss account was disappointing. In the first place the orders secured were lower in value than in the previous year, due almost entirely to a sudden falling off in export orders. Certain foreign governments which were in the market for the company's products demanded long credits notwithstanding their unsettled economic position and their unconventional economic principles. The board could have obtained sufficient business of that kind to have increased the turnover substantially, but it was decided that the risks were too great, and attention was directed elsewhere. In the latter part of the year the Power & Traction Finance Co. obtained a contract in Greece to the value of over two millions sterling. So far as the contractors were concerned, the transaction was on a cash basis, and of the total contract a large part represented plant and material to be manufactured in the company's works. The negotiations for that important contract were prolonged and none of the orders came into the books during the year under review and only a portion of the work would fall into the current year. There had recently been an improve-

ment in orders secured and at the present time they had unexecuted orders exceeding in the aggregate the whole output of 1925. While there were not to their knowledge any orders in hand which were unprofitable, if the negotiations proceeding between the Engineering Employers' Federation and the unions should result in a stoppage of work or a considerable advance in wages, the company's results would be materially affected. In comparing their results with those of some competitors it had to be remembered that their business was largely confined to the heavy side of electrical engineering. The company did not manufacture cables and apart from a small interest in the Siemens & English Electric Lamp Co., Ltd., it derived no revenue from lamps, radio apparatus, or electrical supplies. On the technical side progress had continued and the company stood higher to-day in technical achievement than at any previous time. The Great Indian Peninsula Railway, the first railway in India to be electrified, was running satisfactorily, as was the newly-electrified section of the Southern Railway. Their water-wheel installations in Brazil and India were operating efficiently and reliably. In steam turbines their new double-cylinder machine had produced an efficiency which it was impossible to reach with the ordinary single-cylinder machine, and they had several more sets on order similar to the initial 20,000-kW installation. The unsettled situation of the coal industries affected their very considerable colliery trade. At the present moment few collieries were prepared to proceed with their normal programmes of electrification. The present uncertainty regarding electricity supply was not only affecting supply undertakings themselves but large industrial electrification schemes were being held up for lack of definite information whether it would be cheaper to take a bulk supply than to install generating plant. During Mr. Pybus's absence, through ill-health, Mr. V. Watlington took up the position of managing director, and performed the duties of that office very satisfactorily, and he had consented to retain it. It was necessary for a company like theirs to have a chairman who could devote practically the whole of his time to the company. Unfortunately, his (Sir Charles's) other engagements precluded that and he had recommended that Mr. Pybus should be appointed chairman and that had been adopted. He felt that with Mr. Pybus and Mr. Watlington devoting their energies to the service of the company, the question of management would be put into the best possible shape. The board had asked him to become deputy-chairman, which he was very glad to do. Mr. W. L. Hichens seconded the motion, which was carried after a short discussion.

Johnson and Phillips, Ltd. The profit for the past year, after providing for bad debts, and charging to revenue about £21,000 for maintenance of buildings, plant, &c., was £209,897. Adding £127,792 brought forward, less £50,000 paid in dividends in May last, there is an available balance of £287,689. After meeting directors' fees, debenture interest, &c., transferring £43,750 to reserve, and debiting a 7½ per cent. dividend paid in November last, there remains a balance of £152,132. It is proposed to pay a final dividend of 10 per cent. on the old ordinary shares, making 17½ per cent. for the year, and a dividend of 10 per cent. on the new ordinary shares, leaving £92,133 to be carried forward. The premiums in respect of the shares issued in 1924 and 1925, amounting to £106,250, have been transferred to the reserve, which now stands at £250,000. The meeting was to be held yesterday (Thursday).

German Companies. The *Wolfram Lamp Company*, of Augsburg, proposes to increase the rate of dividend from 6 per cent. to 10 per cent. for 1925.

The *Company for Electrical Undertakings*, Berlin, which is an investment concern, reports net profits of 4,730,000 marks for 1925, as compared with 2,670,000 marks in the previous year, and the rate of dividend is increased from 6 per cent. to 10 per cent.

The *Electra Company*, Dresden, which is financially interested in a number of electrical undertakings, reports net profits of 1,230,000 marks for 1925 as compared with 840,000 marks in the nine months forming the preceding year. It is proposed to pay a dividend at the rate of 10 per cent., as in 1924.

The *Bavarian Aluminium (Innwerk) Company*, Munich, after having written off 660,000 marks for depreciation, has closed its first year's activity with net profits of 862,000 marks, permitting of the payment of a dividend at the rate of 6 per cent. The undertaking has been transferred to the United Aluminium Works Company, which is owned by the Reich, in return for the issue of shares in the latter company.

The *North German Cable Works Company* reports that it would have been possible to have earned moderate profits in 1925 if it had not been for the quietness which set in during the latter part of the year to such an extent that two-thirds of the men had to be dismissed and some departments brought to a complete standstill. After having made provision for depreciation the accounts indicate net profits of 25,000 marks, as against 101,000 marks in 1924, when a rate of 5 per cent. was paid; no distribution is proposed.

The *United Aluminium Works Company*, Lauterwerk (Lausitz), which is a State undertaking, reports that the stock of orders brought into 1925 was comparatively important. Down to May business was brisk at satisfactory prices, but afterwards the rolling mills and makers of aluminium manufactures suffered from the bad economic situation, so that there was a falling off in the receipt of new orders, and prices became depressed. As a consequence the net results, despite the starting of the Toging aluminium works, were only slightly more favourable than in 1924. With the bringing into operation of the latter works the production increased from 11,800 tons in 1924 to 19,400 tons last year. The bauxite mines in which the company is interested were further developed and will ensure a supply of raw material for decades. The accounts show net profits of 3,930,000 marks, as compared with 3,570,000 marks in 1924, and the dividend is maintained at 7½ per cent.

Swiss Companies. The *Swiss Company for Electrical Industry*, Basle, which is a holding company, reports that the tendency to improvement continued in 1925 and in many respects became strengthened. At the same time the opportunity for the profitable disposal of interests in certain Italian, Czecho-Slovakian and German undertakings had presented itself. The net profits are returned at 4,710,000 fr., as against 2,290,000 fr. in 1924; the rate of dividend remains at 8 per cent.

The chairman of the *Neuhausen Aluminium Company*, speaking at the recent annual meeting, is reported to have stated that the German companies had been able to reduce their debts to the Swiss company by 800,000 fr., but none of them had been able to pay any dividends.

The *Power Transmission Company*, Rheinfelden, which belongs to the A.E.G. and Lahmeyer concern, states that the sale of energy reached an unprecedented level in 1925, although the unfavourable conditions during the current year are exercising an influence on the consumption. After negotiations extending over 16 years the way was made clear to a concession for the establishment of new hydro-electric works of 10,000 h.p. above Rheinfelden at Ryburg-Schworstadt, at an estimated expenditure of 60,000,000 fr. The net profits for 1925 amount to 1,430,000 fr., as against 1,160,000 fr. in the previous year, and the dividend is increased from 8 to 10 per cent.

Belgian Company.—The directors of the *Société Belge pour la Manufacture des Câbles et Fils Electriques* state that after providing for depreciation, the net profits for 1925 amount to 1,000,000 fr., permitting of the payment of a dividend of 25.45 fr. per share on the ordinary capital.

French Company.—The *Société de Construction Electrique*, of Lyons, has declared a dividend at the rate of 8.50 fr. per share gross out of net profits and balance forward amounting to 471,000 fr. in 1925.

Dutch Company.—*Philips Glowlamp Works.*—It is reported that the directors of this company are again declaring a dividend of 16 per cent. upon the common stock.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Ever-Ready Co. (Great Britain).—49,800 ordinary shares of £1 each, fully paid, Nos. 449,001 to 498,800.

Oxford Electric Co.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000; and 55,000 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 55,000.

South-eastern Power and Light Co.—$22,228,800 6 per cent. gold debentures, Series "A," Nos. M1 to 18,098 ($1,000), D1 to 8,000 ($500), and C1 to 1,308 ($100).

Stewarts & Lloyds.—39,130 deferred shares of £1 each, fully paid, Nos. 4,035,580 to 4,074,709.

Traction and Power Securities Co.—£34,964 4½ per cent. debenture stock.

Application has been made to the committee to allow the following to be officially quoted:—

Electrical Finance and Securities.—76,162 shares of £1 each, fully paid, Nos. 1 to 76,162.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Midland Electric Corporation for Power Distribution.—70,000 new ordinary shares of £1 each, issued at par, partly paid and fully paid, Nos. 280,001 to 350,000.

Oxford Electric Co.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000; 55,000 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 55,000.

South-eastern Power and Light.—$10,000,000 6 per cent. gold debentures, Series "A," within Nos. M1 to 18,098 ($1,000), D1 to 8,000 ($500), and C1 to 1,308 ($100).

Stewarts & Lloyds.—39,130 deferred shares of £1 each, fully paid, Nos. 4,035,580 to 4,074,709.

Traction and Power Securities Co.—£34,964 4½ per cent. debenture stock.

National Electric Construction Co., Ltd.—The report for 1925 shows a profit of £21,891, and after deducting debenture interest, depreciation, &c., and adding £4,721, there was an available balance of £21,137. It was recommended that this balance should be dealt with as follows:—To reserve and renewals account, Dewsbury and Ossett Tramways, £1,000; to dividend-equalisation reserve, £1,000; to general reserve, £7,000; dividend of 10 per cent., £6,747; carried forward, £5,390. The dividends from the undertakings in which the company is interested were well maintained and the profit from contracting work was again satisfactory. The meeting was to be held yesterday (Thursday).

Northern General Transport Co., Ltd.—In his speech at the annual meeting, on April 22nd, the chairman (Mr. R. J. Howley, C.B.E.), dealt principally with the motor omnibus side of the company's affairs. Referring to the tramway undertakings, he said that the Gateshead & District Tramways Co. and the Tynemouth & District Electric Traction Co. continued to do well, but he thought that the position of the Jarrow and District Electric Traction Co. could not be expected to show improvement until the shipbuilding industry recovered to a substantial extent. The report and accounts were adopted and subsequently a resolution was carried increasing the capital of the company to £700,000.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The directors have decided not to pay any further dividends on any of the preference stocks in respect of the year 1925.

Indo-European Telegraph Co., Ltd.—The report for the past year showed that the revenue increased from £294,371 in 1924 to £310,345. After providing for taxation and adding £18,779 brought forward there remained a balance of £133,838, which it was proposed to distribute as follows:—Writing down cost of reconstruction of the line in Russia and Poland, £5,000; a final dividend of £1 2s. 6d. per share, making 7 per cent. for the year, and a bonus of 15s. per share, both free of tax; £5,000 to dividend-equalisation fund; and £15,000 to retirement trust fund, leaving £16,339 to be carried forward. The meeting was to be held yesterday (Thursday).

Melbourne Electric Supply Co., Ltd.—The report for a period of fourteen and two-fifths months ended November 12th, 1925, shows a balance at the credit of profit and loss account of £567,610, as compared with £414,071 for the preceding 12 months. After providing for debenture interest, &c., and adding £23,336 brought forward, there is an available balance of £449,059. Of this £270,988 is transferred to general reserve, £20,000 to income tax reserve, £4,000 to reserve for bad debts and £10,000 to staff pension fund A final dividend of 5 per cent. actual has been paid on the ordinary shares, making 10 per cent., free of tax, for the year ended August 31st, 1925.

Babcock & Wilcox, Ltd.—In presenting the report for 1925 (*vide* ELEC. REV., April 16th, p. 630) at the annual meeting on April 20th, the chairman (Sir John Dewrance) said that the company was fortunate to be able to show such good results at a time of severe depression in the engineering industry. He hoped that no further labour troubles would supervene to worsen the position. If the threatened engineering strike could be averted and the trouble in the coal industry cleared up, there was every prospect of an even more satisfactory year for the company.

City Electric Light Co., Ltd.—The report of this company (of Brisbane) for the year ended January 31st last showed that after making provision for sinking fund, renewals, &c., and adding a sum of £17 brought forward, there remained a balance of £104,875. Out of the year's profits the directors paid an interim dividend in September last, amounting to £50,288, and they recommended a further dividend of 3 per cent. upon the 6 per cent. preference shares, 3½ per cent. on the 7 per cent. preference shares, and 5 per cent. on the ordinary shares, in proportion to the amount paid thereon, free of State tax. This absorbed £54,535, leaving a balance of £52 to be carried forward.

Urban Electric Supply Co., Ltd.—The directors' report for 1925 records a profit of £91,905, to which is added £10,892 brought forward, making £102,797. After paying the interim preference dividend and purchasing £74 of funded certificates, it is proposed to place £35,000 to depreciation reserve, £10,000 to general reserve, to pay the final preference dividend, to purchase £1,250 of funded certificates, and to pay a dividend of 7 per cent. on the ordinary shares, leaving £18,683 to be carried forward. The meeting was to be held yesterday (Thursday).

Greenock and Port Glasgow Tramways Co., Ltd.—The surplus for 1925, after providing for renewals, &c., is £2,766, and the addition of £689 brought forward makes available £3,456. It is proposed to transfer £1,084 to reserve and to carry forward the balance (£2,372). The company has purchased motor omnibuses to combat competition. During the year mortgages were redeemed to the extent of £32,500, and £33,999 released from sinking fund was transferred to reserve. Meeting: May 3rd.

Hadfields, Ltd.—The report for 1925 states that the company, in common with others, suffered during the year from the severe cutting of prices. The directors recommend a dividend of 3 per cent. on the ordinary shares, leaving £83,204 to be carried forward. The company has acquired approximately three-quarters of the share and debenture capital of Messrs. A. Harper, Sons & Bean, Ltd., and a satisfactory return is expected. Meeting: To-day (Friday).

Newmarket Electric Light Co., Ltd.—The directors' report for 1925 stated that the balance on the year's working, after providing for debenture interest, depreciation, &c., amounted to £3,248, and the addition of £485 brought forward gave an available balance of £3,733. A dividend of 8 per cent., free of tax, is paid, £1,000 is transferred to general reserve, and a balance of £608 is carried forward.

Prospectus.—*Northampton Electric Light and Power Co., Ltd.*—The directors have issued to shareholders particulars of and forms of application for 70,000 ordinary "B" shares of £1 each at 27s. per share. Renunciation letters accompany the prospectus. The issue is to provide capital to meet rapidly increasing business. Applications have to be sent to the Bank by May 12th.

Swansea Improvements and Tramways Co., Ltd.—The net profit for the past year, after providing £20,000 for renewals, was £13,847—an increase of £534. A dividend of 6 per cent. (as for 1924) is being paid on the ordinary shares, £3,000 is put to reserve, and £7,969 is carried forward.

G. D. Peters & Co., Ltd.—The report for 1925 shows a net profit of £7,203, to which is added £3,316, including the sum brought forward. After meeting taxation and paying the preference dividend for the first half of the year, it is proposed to carry forward £4,150.

Herbert Morris, Ltd.—A dividend at the rate of 7½ per cent. per annum has been declared on the ordinary shares for the half-year ended January 31st last.

Montreal Light, Heat and Power Co.—A dividend of $2 per common share has been declared in respect of the quarter ending April 30th.

Stocks and Shares.

MONDAY EVENING.

THE Budget influences at work in the Stock Exchange were slight as compared with those exercised by the varying phases of the coal crisis, which change from day to day in such a fashion as to render markets cheerful in one session and disconsolate in the next. With the outlook altering almost hour by hour according to the results of the various meetings which are being held, it is not possible to expect Stock Exchange business to show expansion. There are, however, some markets in which activity prevails, and amongst these the section devoted to Underground Electric issues is the hub of lively speculation and speculative investment.

Following upon the rise of last week, the Underground £10 shares are another ¼ up at 3¾, while the "A" hold their gain at 12s. A fair amount of attention is being devoted to the company's 6 per cent. income bonds, the dividends on which are paid, of course, free of tax. Being an income bond, the interest is dependent upon the earnings of each half-year, and this gives the stock its speculative flavour. It is within comparatively recent years that the bonds have received their full 6 per cent., but in view of the progress made by the company, they are now worth including in any sound list of speculative securities that yield a good return on the money. The likelihood of capital appreciation is bounded by the consideration that, in a reorganisation scheme of the company's capital, these bonds might be repaid at par. London and Suburban Traction preference are better, while London United Tramway debenture is left at 48.

St. James' and Pall Mall shares have come into demand, and at 16¼ are 5s. up. Westminsters are better at 43s. 3d. Chelseas rose to 2, and City of London ordinary to 45s. 9d. Urban ordinary and preference have moved up. The moderate stream of selling which has been going on in the electricity supply share market for some time past, and for which the Government's Bill has been responsible, is now less obvious, and the effect of the demand from investment becomes apparent in these improved quotations. The provincial shares are better with those of the London companies. Midland Counties ordinary have recovered to their par value. Yorkshire Electrics are 1s. up at 27s. 6d. Bournemouth and Poole show a nominal fall at 55s. 9d., but this is ex dividend and bonus, so that the net result is negligible. Electric Supply Corporation shares have recovered the dividend deducted from the price last Thursday. The market as a whole may be described as stronger than recently has been the case. The Budget is favourable, rather than otherwise, to gilt-edged and investment issues. The Chancellor of the Exchequer has dealt but light blows to the Stock Exchange this time.

The General Electric Company is about to divide its existing 1,850,000 common shares of $100 each into 7,400,000 stock of no par value. It may be remembered that the company holds the controlling interest in the British Thomson-Houston Co., Ltd. The Americans are fond of the "no par" value denomination for stocks and shares, though the British investor is not sufficiently familiarised with the system for it to attract support on this side. One of the objections heard against it is that, where shares are of no par value, this opens an easy door to manipulation of prices in the market. Many of the best-class American companies, such, for instance, as the General Electric, having adopted the principle, the latter is likely to become better known in this country by reason of the favour with which some British investors regard stocks and shares in American companies, which are held to be less liable to labour disturbances than those which trouble our domestic industries.

The telegraph market is steady, though Great Northerns are another £1 down on top of the £2 fall which they suffered last week. Indo-European hold their advance. The company's report shows a profit of £123,000, an increase of about £12,000 on the previous year's figures. The bonus, as we mentioned last week, has been increased. Oriental Telephones are a little harder. Automatic Telephones, nominally 1/16th lower, are actually unchanged, the price being now ex dividend. Marconis lack public interest and the group is quiet.

Anglo-Argentine Trams are a good market, although no further developments have occurred so far as published information goes. There is an impression that the trouble between the Buenos Aires Municipality and the company is in a fair way to becoming settled. Brazilian Tractions are better, and Meixcan Light preferred show a gain of 3 points. The company's common shares are, however, 2 down at 29¼.

Amongst manufacturing shares, Telegraph Constructions have lost 10s., but apart from this decline the list is not bad. Babcocks, now ex dividend and bonus, are quoted at 50s. Johnson & Phillips strengthened, and English Electrics further hardened as a result of the meeting. Rubber shares enjoyed an all-round advance on the Colonial Office modification of the Stevenson scheme. The alteration fixes 1s. 9d. per lb. as the pivotal price around which the next change of exportable allowance shall revolve. The move came as a very pleasant surprise to the market, and completely changed the previously dull complexion of prices. It is taken for granted that there will be a loud outcry of protest from American consumer interests.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1924	1925.	Price Apr. 26 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	55/9 x all	—	4 16 0
Brompton Ordinary	1	10	10	1⅛	—	*5 9 1
Charing Cross Ordinary	1	15	15	45/9	—	6 11 2
do. do. 4½ Pref. ...	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	+1/16	6 0 0
City of London	1	15	15	47/9	+1/16	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/6	—	5 16 5
County of London	1	15	15	56/-	—	5 7
do. do. 6 % Pref.... ...	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	—	6 1 9
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation	1	10	10	22/6xd.	+1/16	6 3 0
Kensington Ordinary	5	15	15	13½	—	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5¾	—	5 11 7
Metropolitan	1	11	11	35/9	—	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	+6d.	6 0 0
Newcastle-on-Tyne Ordinary ...	1	7	7	22/-	—	6 7 3
do. 5% Pref. ...	1	5	5	18/-	—	5 11 1
do. 7% Pref. ...	1	7	7	24/6	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16½	+¼	5 8 6
South London...	1	15	15	9¾	—¼	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	22/-	+1/6	3 12 9
do. 6% Pref.	1	6	6	1xd.	+6d.	6 0 0
Westminster Ordinary	1	15	15	43/3	+1/8	6 18 9
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	20/-	—	7 10 0
Yorkshire Elec.	1	8	8	27/6	+1/-	5 16 5

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	66½	+½	7 10 5
do. District	,,	3½	3½	£2	+1	6 17 8
Underground Electric Ordinary ...	10	Nil	Nil	3¾	+¼	Nil
do. do. "A" ...	1/-	Nil	Nil	12/-	—	Nil
do. do. Income ...	Bonds	6	6	100	—	*6 0 0

TELEGRAPHS AND TELEPHONES.

		Dividend. 1923.	1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	101xd.	—	5 1* 10
do. Def.	,,	1½	1½	23⅞	—	6 6 4
Automatic Telephone	1	3	6	2¼xd.	—	4 4 3
Chili Telephone	5	6	5	6¾	+¼	*3 12 9
Cuba Sub. Ord.	10	5	5	6½	—	7 8 2
Eastern Extension	10	10	10	17½	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 12 8
do. do. Pref.	10	6	6	10½	—	5 11 7
Great Northern Tel.	10	22	22	29	—1	7 11 8
Indo-European	25	8½	10	47½	—	*5 5 3
Marconi...	1	10	10	1⅛	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	42/-	+9d.	*5 14 3
United R. Plate Tel....	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17½	—	*5 15 11

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	£0/9	+9d.	9 1
do. do. 2nd Pref. ...	5	6	6	2½	+⅛	11 3
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord. ...	,,	6	6	127½	—	4 14 0
do. do. 6% Pref. ...	,	6	6	107	—	5 13 2
Brazil Traction	100	4	4	91½	+1	5 9 3
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	85½	—	5 17 0
do. do. Preferred ...	,,	90/-	90/-	105½	—	*4 9 4
do. do. Deferred ...	,,	129/5	129/5	126	—1	*5 3 2
do. do. Deb. ...	,,	4¼	4¼	75	—	5 13 4
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	48	—	8 6 8
Mexico Trams. 5% Bonds	—	5	5	64	+1½	7 16 4
Mexican Light Common	100	Nil	Nil	29½	—2	Nil
do. Pref.	100	Nil	Nil	72½	+3	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	2½xd.	—	*5 4 0
British Aluminium Ord.	1	5	10	40/6	—9d	4 18 9
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3½	—	4 16 0
Brush Ord.	1	10	10	25/9	—	7 15 4
Callenders	1	15	15	3⅞	—	4 0 0
do. 6½% Pref....	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	7/9	—	5 3 3
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	30/-	—	6 13 4
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	15/9	+9d.	6 7 0
do. do. Pref.	1	6	6	18/3	—	6 11 6
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	26/3	—	5 6 2
Henley	1	15	16	3⅞	—	4 5 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber...	1	5	5	22/6	+6d.	*4 8 11
Johnson & Phillips	1	10	10	2⅛	—1/8	3 8 0
Met.-Vickers Ord.	1	8	8	2 1/-	—1/6	6 19
do. Pref.	2	8	8	2⅝	—	6 14
Siemens Ord.	1	—	7½	1⅞	—	4 16
Telegraph Construction	12	20	10	27½	—½	*4 7

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price April 27th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots...	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£250	£5 dec.
Grade II	,, ,,	£175	£3 dec.
Grade III...	,, ,,	£95	£1 dec.
c Brass (rolled metal 3' to 12' basis)	per lb.	1⅛...	...
c ,, Tubes (solid drawn) ...	,,	11¼d. to 1/-	...
c ,, Wire, basis	,,	9¼d.	...
c Copper Tubes (solid drawn) ...	,,	1/0½	...
c ,, Bars (best selected) ...	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars ...	,,	£65 10s.	20/- inc.
d ,, ,, Sheets ...	,,	£14 5 10s.	...
g ,, ,, Wire Rods	,,	£75 .0s.	20/- inc.
d ,, ,, H.C. Wire	per lb.	9½ d.	½d. inc.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine ...	,,	1/11	2d. dec.
l Iron Pig (Cleveland Warrants) ...	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£30 5s.	5/- dec.
g Mercury	per bot.	£15	10/- to 15/-
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire...	,,	1/3½	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	1/-	...
r Steel, Magnet, in bars	,,	7¾d.	...
m Tin, Block (English)	per ton.	£276 15s. to £277 5s.	£5 15s. dec.
m ,, Wire, Nos. 1 to 16	per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
m P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

Works and Staff Magazines.—The Fifth Conference of Editors of Works and Staff Magazines, organised by the Industrial Welfare Society, was held in Caxton Hall, Westminster, on Friday last. Since 1920, when the first of this series of conferences was held, the attendance has increased steadily, and over 100 firms were represented by about 120 delegates on this occasion. Papers were read and discussed, and at a luncheon in connection with the Conference, at the Hotel Rubens, Sir Ernest Benn, C.B.E., and Captain Harold Macmillan, M.P., addressed the delegates.

Standardisation in Australia.—A conference of secretaries of the Australian Commonwealth Engineering Standards Association, established towards the end of 1922, was held in February, officers from headquarters (Sydney), from Adelaide, Brisbane, Melbourne and Hobart being present. The chairman (Mr. E. S. Maclean) drew attention to the rapid progress of work and growing support in introducing the principles of standardisation into industry. From a report by the engineer-secretary, Mr. W. R. Hebblewhite, the *Melbourne Age* noted that 153 sectional, sub- and panel committees have been constituted, involving a total membership of approximately 1,000. No fewer than 138 specifications were under consideration, of which 27 had been published, and 15 would be issued shortly. The subjects included machine parts, electrical material, railway and tramway rails, rolling stock material, and colliery equipment. A complete organisation had been established to complete a survey of the power resources of Australia with a view to making recommendations for its utilisation. State Governments had been very sympathetic, and officers of various departments had been encouraged to assist the various sub-committees.

The New Metro-Vick Showrooms.

Facilities for Contractors.

THE recently-opened showrooms and offices of the Metropolitan-Vickers Electrical Co., Ltd., and Metro-Vick Supplies, Ltd., in Charing Cross Road, W.C.2, are an excellent example of their kind, being situated in an almost ideal position, and possessing ample space for the correct display of fittings and appliances. The premises were formerly employed as a pickle and preserve factory by Messrs. Crosse & Blackwell. The substantial outer walls have been retained, but the interior has been reconstructed to meet the new requirements. There is a basement, the ground floor and four storeys above, and distinction is added to the building by a turret at the corner seen from the busy Oxford Street, upon which illuminated signs have been fitted. The corner of the ground floor directly beneath the turret has been equipped with attractive open windows, in which appliances are displayed and illuminated at night by an efficient window-lighting system. The outer showroom is handsomely panelled in walnut, and the floor is covered with rubber tile flooring. The main showroom, three views of which are reproduced herewith (figs. 2, 3 and 4), is a very spacious apartment, and the decorative scheme has been admirably carried out. Each lighting fitting is given plenty of room (which is not always the case), and can be seen to advantage. In the centre of the showroom is a glass-panelled case, in which a selection of domestic appliances, &c., is shown.

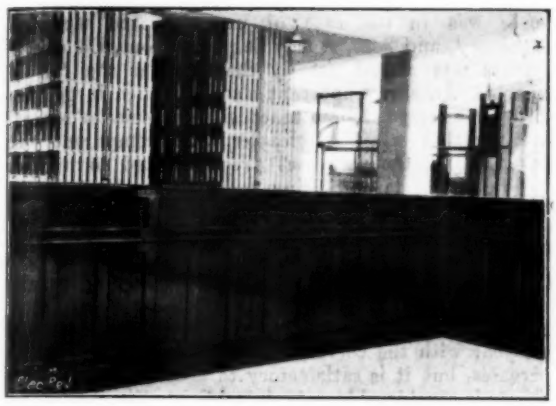
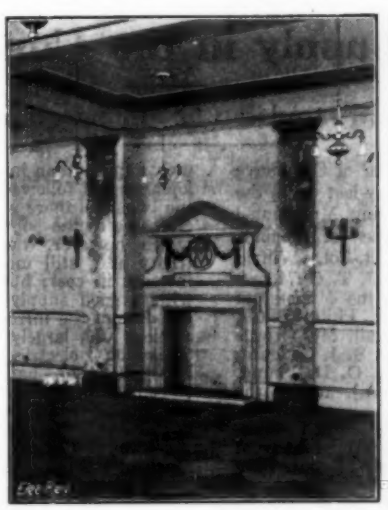


Fig. 1.—The Trade Counter.

Fig. 2.—A View of the Main Showroom.



Figs. 3 and 4.—Corners of the Main Showroom.

The exhibits include radio apparatus, but actual demonstrations of this are carried out in a smaller adjacent room. The store-rooms are capacious, and enable large supplies of lamps, fittings and appliances to be held at the premises. The trade counter (fig. 1) is conveniently situated, and in consonance with the rest of the arrangements, is of ample dimensions leading to quick service. The furnishing of the main showroom was carried out by Messrs. Waring & Gillow, Ltd., to the designs of Messrs. Yates, Cook & Darbyshire, and the floor-coverings were supplied by Messrs. George Spencer Moulton. The wiring and lighting arrangements were carried out by The Engineering Works (Electrical and General), Ltd., under the supervision of the Illuminating Engineering Department of Metro-Vick Supplies, Ltd. Messrs. Harcourts, Ltd., a subsidiary of Metropolitan-Vickers, provided the interior art-metal work. The facilities thus provided are for the trade only. Books of introductory tickets for the use of contractors' customers are being provided.

Metro-Vick House is situated near the Tottenham Court Road "Underground" station, and there are numerous services of omnibuses passing the premises.

The facilities provided for trade customers include an illuminating engineering department, and a writing room with stenographic service. The bulk of the building is occupied by the services of Metro-Vick Supplies, Ltd., but a number of the departments of the Metropolitan-Vickers Electrical Co., Ltd., are also housed there. These are:—The offices of the motor and plant department; meter office, stores, and testing laboratory; and the London erection stores and offices.

Exports and Imports of Electrical Goods and Machinery in March, 1926.

THE Board of Trade Returns of our foreign trade in electrical goods during March, although not very satisfactory in comparison with the preceding month, show up better against the March, 1925, figures, which is, no doubt, a fairer comparison in view of seasonal fluctuations. The exports declined by £99,275 from the February level. The decrease was fairly general, but was considerably off-set by four increases, the most important of which occurred in the case of submarine, telegraph and telephone cable (£45,552). The exports of batteries and accumulators, insulated wires and cables, unenumerated electrical machinery and "other" motors and generators showed very considerable decreases. The machinery section exhibited smaller exports in all classes, but in the telegraph and telephone section there was a substantial rise. Comparing the figures with those of March, 1925, it is seen that increases and decreases were balanced between the items. Insulated wires and cables make the most satisfactory showing, but the machinery section displays a decline, while the telegraph and telephone section shows a rise.

Turning to the imports, it is observed that only three decreases occurred, the most marked of which was in telegraph and telephone instruments. The largest increase was in the case of unenumerated electrical machinery, and here, it may be pointed out, the rise in imports was almost exactly the same as the fall in exports. Another important class in which larger imports were recorded simultaneously with smaller exports was insulated wires and cables. As compared with March, 1925, the decreases preponderated in number and value, the largest being again in the case of telegraph and telephone apparatus. Insulated wires and cables experienced the greatest increase.

The re-exports show a considerable rise in both comparisons, the increase being fairly generally distributed.

All three sections, comparing the first three months of this year with the corresponding period of 1925, show decreases, but it is satisfactory to note that the fall in exports is considerably outweighed by that in the import section.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1926.	Inc. or dec. as compared with Feb., 1926.	Inc. or dec. as compared with Mar., 1925.	Electrical imports for Mar., 1926.	Inc. or dec. as compared with Feb., 1926.	Inc. or dec. as compared with Mar., 1925.	Electrical re-exports for Mar., 1926.	Inc. or dec. as compared with Feb., 1926.	Inc. or dec. as compared with Mar., 1925.
Electrical goods and apparatus (unenumerated)	£191,155	+ £32,181	+ £34,301	£88,866	+ £9,238	− £6,722	£7,306	+ £2,736	+ £1,621
Insulated wires and cables	292,869	− 47,654	+ 52,760	62,521	+ 17,510	+ 12,899	1,974	+ 1,318	+ 651
Glow lamps	41,035	− 3,639	− 2,276	22,079	+ 5,379	− 6,765	1,107	− 1,464	+ 741
Arc lamps and parts	894	− 318	+ 361	1,128	+ 1,013	+ 282	1,404	+ 1,383	+ 1,403
Batteries and accumulators	67,597	− 33,327	− 24,324	36,979	+ 9,971	+ 9,802	2,202	+ 1,542	+ 1,454
Meters and instruments	36,196	+ 6,792	+ 4,118	23,586	+ 9,790	− 3,826	1,672	+ 288	+ 764
Carbons	1,271	− 410	− 3,385	8,881	+ 3,726	+ 617	188	+ 102	− 75
Electrical Machinery—									
Electrical machinery (unenumerated)	272,649	− 65,775	− 4,190	117,155	+ 65,721	− 10,854	11,758	+ 7,039	+ 6,616
Railway and tramway motors	44,274	− 2,794	− 8,363	—	—	—	—	—	—
Other motors and generators	167,499	− 38,066	+ 12,063	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	3,408	− 1,492	− 2,070	4	− 2	− 59	18	− 8	+ 18
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	86,907	+ 25,077	+ 19,095	9,821	− 6,475	− 8,579	22	− 7	− 75
Submarine telegraph and telephone cable	49,601	+ 45,552	+ 38,835	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	223,921	− 15,402	− 36,853	34,090	− 14,377	− 42,439	4,667	− 544	− 875
Totals	£1,479,267	− £99,275	+ £80,072	£405,110	+ £101,634	− £55,644	£32,318	+ £12,381	+ £12,243
	Exports.			Imports.			Re-exports.		
Decreases for three months of 1926	− £153,208			− £227,708			− £9,105		

Electricity Supply in the United States.

An Interesting Address by Mr. Samuel Insull.

AT a luncheon given by the American Chamber of Commerce in London (Inc.) at the Hotel Cecil on Thursday last week, the hon. treasurer, Mr Robert Grant, Junr., presiding, Mr. Samuel Insull, of Chicago, U.S.A., was the guest of honour. Amongst the many other guests were Lt.-Col. Wilfrid Ashley, M.P., Minister of Transport, Lt.-Col. J. T. C. Moore-Brabazon, M.P., Parliamentary Secretary to the Minister of Transport, Mr. H. E. Levis, Maj.-Gen. Sir Philip Nash, K.C.M.G., Mr. C. H. Merz, Dr. H. F. Parshall, Mr. George Balfour, M.P., Mr. T. P. O'Connor, M.P., Mr. S. J. Goddard, Mr. R. A. Chattock, Pres. I.E.E., and Mr. O. D. Young, chairman of the General Electric Co. (U.S.A.), and of the Radio Corporation of America.

In a brief address on electricity supply in the United States, Mr. INSULL said that the conditions there were different from those obtaining in this country; their methods of controlling local monopolies were different from ours, and where we had to go to Parliament for sanctions, they went to the Commissioners of the respective States. The difference in conditions had something to do with the progress of development of power supply; moreover, the United States was a young country, with less respect for vested interests, and hence electricity supply had gone ahead there far more rapidly than in Britain. Up to a certain point, the development had followed similar lines. When Mr. Insull entered the business, there were several systems operating in the same city, due to the popular belief in the virtues of competition—which, however, was disastrous both to the suppliers of electricity and, still more, to the users, owing to the resulting increase in cost; but the city areas were gradually provided with a good supply of electricity. The larger developments dated from the introduction of the steam turbine; Sir Charles Parsons was largely responsible for the modern system of "massing" electrical generation. Dr. Ferranti, too—20 years before his time—had shown the way to the mass production, transmission, and distribution of electricity, whilst Dr. Hopkinson had shown them how to sell it, the instrument which enabled them to arrive at a just scale of charges being also the invention of an Englishman, Mr. Arthur Wright. Thus, much of the information required to put electricity supply on sound lines came from this country.

The massing of production led to the development of general power supply systems over large areas. Round the city of Chicago, in an area of 10,000 square miles, a population of four millions absorbed only 10 per cent. less electricity than the whole of the United Kingdom, though the investment in generating plant was only half as great. The mass production

or "super-power" idea was spreading rapidly in the United States; from Minneapolis to Virginia, and across the Alleghanies, practically the whole region (with very few interruptions) was connected in one vast super-power or "grid" system. The effect of that was to enable them to take advantage of the water power in Wisconsin supplemented by the steam plant in Chicago and the Lake Michigan area, small plants on the coal fields, larger ones on the Ohio River, &c. That was a territory larger than the United Kingdom. Farther south, there was a large interconnected area where the steam plants of Alabama helped out the industries that depended on the water power of North Carolina. On the Pacific Coast, from Canada to Mexico, there was one vast power system, over which energy was transmitted as far as 250 miles in some cases. Power produced very cheaply in the mountains was carried to the great cities over long transmission lines at very high pressures. It was a common thing to see interests financially unconnected, feeding into a common network. The result was that they could build huge power plants and run them with a minimum consumption of fuel.

In five years the fuel saved by the increased efficiency of generating plant in the United States amounted to 60 million tons of coal, a saving of one-third; and the Commonwealth Edison Company carried on through the war without increasing its rates, largely as the result of the higher efficiency of the apparatus employed.

The interconnection of distribution systems allowed of the massing of production in plant of the highest possible efficiency and of large size. A common size of turbo-generator was 40,000 kW; in larger stations they were installing sets of 60,000, 75,000, and 80,000 kW. In a new station for which they were just breaking ground, the first set would be of 200,000-kW output. A low cost of power was attained not only in big centres but also in small communities, and would have a notable effect on social conditions. Mr. Henry Ford had in view a scheme for the manufacture of motor-car parts in rural areas. By cheap power they hoped to check the drift from the country to the town; by supplying electric light and power to farmhouses, they would change the conditions of living entirely. The availability of cheap power in small communities would lead to the old-fashioned method of specialising in local manufactures. The conditions under which children could be brought up would be improved, and the vast movement going on in America quite possibly might largely revolutionise the conditions under which people lived in country towns.

The question was of peculiar importance to Britain. They were subject to drastic regulations and much interference with business in the United States, which would be distasteful to Englishmen, but they profited by close contact with the members of the Public Service Commissions; in America there was less protection from competition than in this country, but they went ahead with the work as a commercial proposition. He believed in the system, because more money could be made on that basis than out of isolated undertakings—it was all a question of dollars and cents. The right policy of any man serving the public was to supply it at the lowest price that would return a reasonable profit.

No man ever forgot his mother country. The United States was to him the country of opportunity, the country of adoption—he wished the country of his birth to profit by the experience gained in the country of his adoption. He was not talking on theoretical lines, but as one responsible for nearly 250 millions sterling of securities in the hands of the public, and he hoped his electricity supply friends in this country would put aside all selfish interests and even make sacrifices in order to give Britain the service she was entitled to.

The Chairman expressed the thanks of the gathering to Mr. Insull for his address, and Mr. T. P. O'Connor proposed the health of the Chairman, which was heartily honoured.

Australian Industry and Tariffs.

The Position of Electrical Manufacturing.

By G. A. JULIUS, B.Sc.

(Abstract of a Presidential Address before the INSTITUTION OF ENGINEERS, AUSTRALIA.)

WE live in an age of manufacturing and that nation is the wealthiest which produces the greatest quantity of manufactured goods with its available labour. Accordingly, Australia aims at being a manufacturing nation, and in recent years a determination has been manifested to make the country self-supporting in every way. Factories have sprung up everywhere and the Federal Government has aided the movement by the imposition of tariffs, the granting of bounties and other means. Here and there, however, a doubt is being felt whether the system is a right one. It is seen that the debt per capita has risen to an enormous extent; that the wages paid have risen to a similar extent and are still rising; and that the average productive activity over all industries is steadily falling. Looking at the experience of Great Britain and the United States it is apparent that the former's development and use of the steam engine was the factor which made her the mistress of the world's wealth. While, however, her rise of recent years has been very steady, enormous advances have been made by the United States. The accepted reason for this is that Great Britain is not now using sufficient mechanical power in her industries to get the most out of her workers. Legislative restrictions have retarded the growth of electricity supply until now Great Britain lags behind the United States in this respect, although steps are being taken to remedy this. America has developed the use of electricity so that now war-time efficiency and economy are permanent conditions of her industrial and home life. The curve of prosperity in the United States has closely followed that showing the increase in the use of power in industry, and this is not due to the protective tariffs which have been imposed upon foreign goods. Statistics show that the American workman adds a value of £600 in the process of manufacture when provided with 3¾ h.p., while the wage earner in Australia, having less than 1¼ h.p. to assist him, adds a value of £322. For every £1,000 spent in wages approximately £2,400 is added to the value of the product in America, as against £1,750 in Australia, in spite of the fact that wages are materially higher in the United States. It is obvious that the industries which employ the largest amount of power produce the greatest wealth, and that those which use little power produce a correspondingly small value per capita. Unfortunately many of the industries employing the largest number of people are among the smallest users of power and it is possible that the application of more power is impracticable. The Australian Government should give every possible encouragement to those industries which use the largest amount of power. Australia stands high as regards "real wages" but this does not appear to be due to increased quantity production, whereas in the United States this is the direct cause of the high wages paid. The statistics reveal that the position of Australian manufacturing industries is not so good as might have been expected, and it would appear that too little use is being made of mechanical power. Everybody should think, talk and act in terms of "more power," since under modern industrial conditions it is mechanical power which creates wealth, and the prosperity of the people is regulated to a considerable extent by the amount of power consumed. The aim should be the expansion of the larger and more efficient factories instead of the increasing of the large number of small establishments. The existing Customs tariff merely encourages any small factory to start that undertakes to make anything at all, necessary or otherwise. The present tendency is well illustrated by the Australian electrical industry which in 1924 was divided up amongst 193 establishments employing 2,641 persons. Of these 55 employed fewer than four hands each, 162 employed fewer than 20 persons each, and only two reported the employment of over 100 persons. Experience teaches that the manufacture of electrical apparatus can only reach its proper effectiveness when carried out under large-scale operations. Unless the industry is organised and carried on in a big way, its products are little more than the output of hand labour, with consequent high costs and loss of efficiency in the utilisation of labour. Comparing the Australian electrical industry with that of the United States, it is seen that the h.p. installed per employé is less than ¼ as against 2. The added value in 1923 for each £1,000 spent in wages was £2,428 in the United States and £1,465 in Australia. Between 1909 and 1923 there was actually a decrease in Australia in the added value per £1,000 of wages, while in the United States there was an increase. In the Australian electrical industry, too, there has been practically no increase in the power installed per employé, whereas in all other industries it has increased from ¾ h.p. in 1908 to about 1¼ h.p. in 1924. Disregarding consideration of the small market in Australia, the necessity for continuous changing of methods and designs must seriously handicap the establishment of electrical manufacturing plants on any adequate scale at present. One of the most potent factors in the remarkable development in electrical engineering in our generation has been the organisation in the older countries of a relatively small number of very large companies, with enormous financial resources, which have enabled them to maintain highly-trained specialists in every branch of design, and their business is of such magnitude that the development cost does not bear unduly on any single product. The establishment of branch or associated factories of home concerns can be considered, but apart from the heavy overhead expenses, it is apparent that, except in particular cases, apparatus thus fabricated in two factories could not be produced as cheaply as if wholly turned out by one factory. Electrical goods, in general, are merely tools for other industries; they should therefore be produced as cheaply as possible. Australia's large debts and

her urgent need of development raise a pressing demand for the creation of national wealth, and this involves the highest efficiency in the utilisation of labour. While the Commonwealth cannot look forward to any material export trade in electrical manufactures, she already exports large quantities of valuable materials which could be worked up into a condition of higher value before shipment.

In 1923-24, Australia paid nearly £859,000 in duty on electrical apparatus, nominally to protect electrical manufacturers in the country, and in 1921 the amount was nearly £933,000. The number of persons employed in the industry was 2,641, with an average wage of £174 per annum, but the total cost to Australia—that is wages and duty together—was £521 per employé. The value added per employé was only £243. Taxation to support the electrical industry was therefore far in excess of the wealth produced by the industry, and undoubtedly retarded the introduction of power into other industries and checked progress. It is calculated that since 1907 an amount of £6,500,000 has been paid in duty on electrical plant (excluding wires and cables). This represents an annual burden of £650,000, and it is now increasing at the rate of £85,000 per annum Not only has this affected industry; it has also retarded the use of electricity in the home, for domestic appliances, particularly cooking ranges, carry a price which makes their use impossible for the majority of people. The main result of the present system is to enhance the cost to the consumer. While it is true that there are electrical factories which are worthy of all possible assistance, there is overwhelming evidence to show that the present method of extending assistance to manufacturers has failed of its purpose. The minor interest of the electrical manufacturer has obscured the major interest of the light and power industry. Although large power-producing installations are being erected, the present policy will rob them of all possibility of real success. The manufacture of electrical apparatus in Australia can never be worth while until a real demand has been created for such apparatus, and this demand can never be created unless the material is available to the public at a reasonable price. The continued starting up of small organisations is unhealthy and can never lead to success.

The issues at stake are so great, and Australia will continue to lose so much if the present policy is adhered to, that there are good grounds for believing that the Government will be ready to handle this question along strictly business lines and to devise some solution for the problem, bearing in mind that whatever plan may be devised its first responsibility is to the people as a whole. If the latter ground were the sole consideration, the correct solution would appear to be absolute free trade so far as essential electrical equipment is concerned. It is noteworthy that New Zealand has practically adopted this policy, admitting the majority of essential electrical apparatus free if British, or with a 10 per cent. duty if foreign. The author ventures to think that if no other satisfactory solution can be found it would be in the interests of an overwhelming majority of the community if such a policy were adopted by Australia, realising, of course, that a relatively small number, the local manufacturers of electrical equipment, would suffer. It is believed, however, that a way can be found which will secure the desired and essential result, without sacrificing the interests of those engaged in electrical manufacture, wherever it is proved to be worth while. That is by the establishment of a system whereby a bounty would be given for such approved articles as were manufactured in Australia. The money saved in duties would more than cover the relatively small sum of money necessary to cover the bounty. By this means it is considered that the development of electrical manufacturing works would be greatly accelerated. For the immediate future the co-operation should be invited of all electrical manufacturing companies, both Australian and otherwise, to assist in educating the Australian people to an appreciation of the domestic and industrial advantages which must accrue from a greatly increased use of electricity.

The Rugby Radio Station.

An All-British £400,000 High-power Telegraph Station.

By E. H. SHAUGHNESSY, O.B.E., M.I.E.E.

(*Abstract of Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHEN the Government decided upon the provision in England of a wireless station with a world-wide range, the Wireless Telegraphy Commission which was originally appointed under the chairmanship of the late Lord Milner with Dr. W. H. Eccles (vice-chairman), Mr. E. H. Shaughnessy and Mr. L. B. Turner as members, undertook its general design and Post Office engineers prepared detailed drawings and designs for the equipment as a whole and for most of the plant.

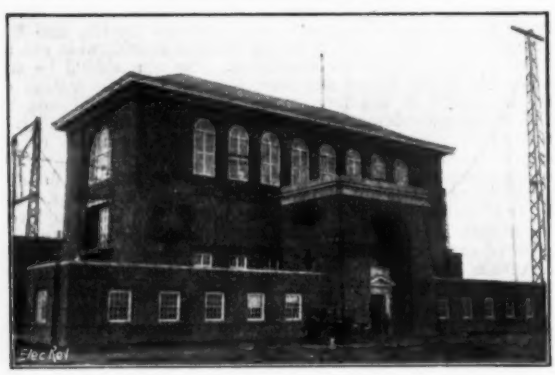


Fig. 1.—The Main Station Building.

To ensure reliable communication when working on a wave-length of about 18,000 m. (16.66 kilocycles) a minimum working current of 500 amperes in an aerial supported on 820-ft. masts would be required, and it was decided that the high-frequency generating valve plant should be capable of dealing with an input of 1,000 kW to provide for a possible necessary low working efficiency of 50 per cent. Such an installation would produce an aerial current of about 700 amperes to meet bad atmospheric conditions. It was decided to erect in the first instance an aerial having a designed capacity of 0.045 μF on 12 insulated 820-ft. masts and to ascertain its limitations. The station buildings are about the centre of the site which has an area of 900 acres (about 1¼ miles long by 1 mile wide) at Hillmorton, about four miles south-east of Rugby.

Power Plant.—Electricity is purchased in bulk from the Leicestershire and Warwickshire Electric Power Co., the incoming supply being 3-phase, 50-cycle, with an earthed neutral and 12,000 volts between phases; automatic regulators are installed at the company's sub-station.

All larger motors (*i.e.*, over 100 kW) are synchronous machines capable of operating on 0.9 leading power factor and as a result the station can be operated on unity power factor.

The e.h.p. a.c. 6-panel switchboard consists of 5 truck cubicles and a metering cubicle, two being connected to the auxiliary 450-kVA transformers situated immediately below the switchboard, whilst a third (of 2,000-kW capacity) controls the main motor-generator sets. The low-pressure, a.c., 416-volt switchboard is of the normal slate pattern containing 16 panels, and controls all auxiliary power. These switchboards, together with a number of others and cabling were supplied by the General Electric Co., Ltd.

The valve transmitter set called for a supply of d.c. power of from 1,000 to 1,500 kW at from 10,000 to 18,000 volts, with the negative side at earth potential, the higher voltage being provided to cope with probable developments in transmitting valves in the near future. Owing to the possible failure of valves, it was essential that whatever type of plant was installed it would have to be capable of standing a dead short-circuit with impunity. Other special requirements were ability to operate under rapidly fluctuating loads, low self-inductance, and absence of voltage ripple, and it was finally decided to install motor-generator sets manufactured by the British

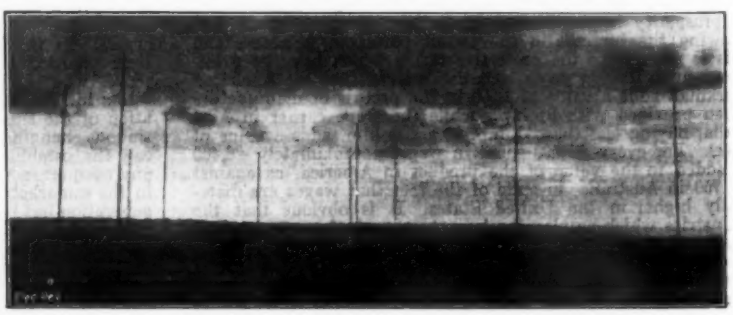


Fig. 2.—A General View of the Masts.

Thomson-Houston Co., Ltd. Three sets are provided, fig. 3, each having an output of 500 kW at 6,000 volts d.c., and consisting of a three-phase self-starting synchronous motor of 640 kVA wound for 2,200 volts between phases, rigidly coupled to two d.c. generators connected in series, and two exciters, one of which is the main exciter and the other the motor field exciter; the main exciter provides field current for both d.c.

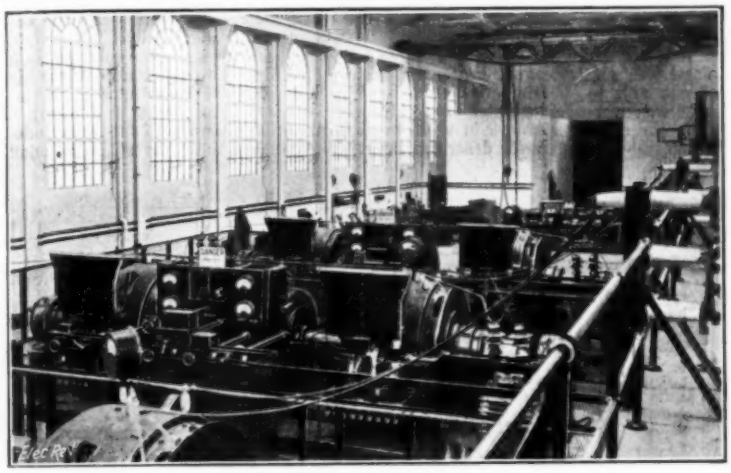


Fig. 3.—Main Motor-generator Room.

generators and for the field of the motor exciter. Each d.c. generator is a bipolar machine of 250 kW at 3,000 volts, provided with interpoles and compensating windings. The magnet frames of cast steel are split diametrically and in order to avoid awkward joints in the pole-face windings the break has been arranged through the centre of the main poles which consist of twin poles, each half carrying its own spool. Another unique feature of the magnetic circuit is a band of laminations incorporated in the yoke to provide an undamped path for the commutating flux under rapidly varying loads. The commutator is of the same diameter as the armature, and all metallic parts in the vicinity of the commutator which are connected to the frame are protected by insulating shields. A series of fan blades mounted between the armature and commutator provides a blast of air across the commutator. The brush gear is completely encased in bronze boxes, the connections to which produce magnetic fields directed to blow out from the machine any arc which may be formed at the brushes.

In order to avoid the use of insulated couplings between motor and generators, each set is supplied with power through a separate transformer, manufactured by Messrs. Johnson and Phillips, wound for 12,000 volts on the primary side and 2,200 volts on the secondary side. The insulation of the secondary winding from the primary winding and core bunched was subjected to a flash test of 50,000 volts. The secondary side is connected directly to the motor terminals by means of a 3-core paper-insulated cable, and all a.c. switchgear is on the primary side of the transformer. The base-plates of each set are insulated from earth by being mounted on groups of porcelain insulators. The neutral point of the motor stator is connected to the base-plate as is also the mid-point between the d.c. generators through a leakage relay. In this way the potential of any portion of the set relative to the frames is limited to 3,000 volts d.c. When working in series each set has a base-plate potential corresponding to its position in the circuit; thus, the first base-plate will be at 3,000 volts, the second at 9,000 volts and the third at 15,000 volts above earth in each case. Each main base-plate carries two high-speed circuit breakers, each connected in series with a generator armature, set for instantaneous tripping on about 5 times full-load current; it inserts a blocking resistance in circuit and at the same time trips the generator field contactor, the contacts being fully opened within 0.02 sec., whilst in order to suppress the generator fields as rapidly as possible the field contactors open the circuit without inserting discharge resistances. Each set is completely surrounded by an earthed metallic screen and the foundations contain a metallic network which is connected to the earthed screens. All controls are operated by means of insulated spindles from outside the screens. The e.h.p. d.c. terminals of each set are connected to a 2-position selector switch mounted on a gallery carrying the busbars; in one position the switch connects the machine in series with the busbars, whilst in the other position the machine is isolated and the gap in the busbars bridged. The switch cubicles were supplied by the British Thomson-Houston Co., Ltd. In spite of the large dimensions of the machines for their output, necessitated by voltage requirements, the test-results showed an over-all efficiency of over 87 per cent.

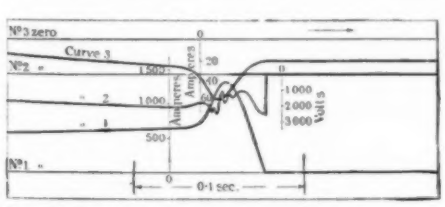
In addition to the ordinary tests, the machines were subjected to short-circuit tests while fully excited; in the case of one set this test was repeated 20 times, in all cases without flash-over or damage of any kind. A copy of oscillograms taken on a single set by the B.T.-H Co. is shown in fig. 5.

The d.c. supply from the busbars is transmitted to the valve room through armoured concentric paper-insulated cables, the inner conductor in each case being the h.p. conductor, whilst the outer conductor carries the return current at approximately earth potential. The cables terminate in a steel cubicle switchboard supplied by the General Electric Co., Ltd., and the use of oil circuit-breakers to rupture h.p. d.c. circuits is thought to be a novelty, but tests on short-circuits of 18,000 volts showed that the switches could successfully clear a fault without damage.

Fig. 4.—Power Valve Units, Exciter Panels, Control Desk and Auxiliary Switchboard (Right).

The valve-filament supply of the station is obtained from two 200-kVA frequency-converter sets, each consisting of a 416-volt, 50-cycle synchronous motor driving a 200-kVA, 354/478-volt, 100-cycle, three-phase alternator. Each set is provided with a pony motor and exciter. Tirrill regulators on each alternator control panel limit a.c. voltage fluctuations, and as an additional safeguard the regulators are fitted with excess-voltage cut-outs to provide against the possible failure of the regulator. The voltage maintained by the Tirrill regulators can be varied by remote control from the valve room.

For the operation of control and protective circuits, and as



Curve 1.—Short-circuit current (1 cm. = 756 amps.)
Curve 2.—Voltage across high-speed breaker, commutating pole, and compensating windings (1 cm. = 3,271.8 volts).
Curve 3.—Shunt field current (1 cm. = 48 amps.).

Fig. 5.—Short-Circuit Oscillogram.

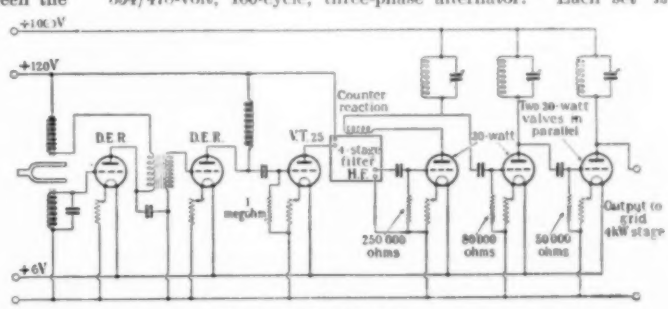


Fig. 6.—Tuning-fork Unit.

an emergency lighting supply, a small secondary battery has been installed with 30-kW charging generator and booster sets in duplicate. All circuits and machines are provided with protective devices designed to prevent damage from high-frequency currents. On the e.h.p., d.c. generator sets, spark-gaps having non-inductive resistances in series are connected across each generator armature; on other machines or feeders straight-filament lamps in cast-iron boxes are shunted across the machine terminals or feeder. In a few cases where the machine current is small a condenser of 2 μF capacity with lamps in series is used. A supply of current was required for providing aircraft obstruction lights on certain masts. As the masts are highly insulated from earth it was impracticable to take a supply directly from the mains. The difficulty was overcome by mounting a 2-kW, 240-volt, d.c. dynamo on the mast and driving it by means of a suitable 50-cycle squirrel-cage

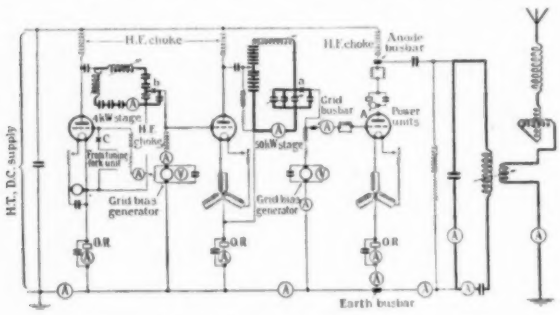


Fig. 7.—Transmitting Circuit.

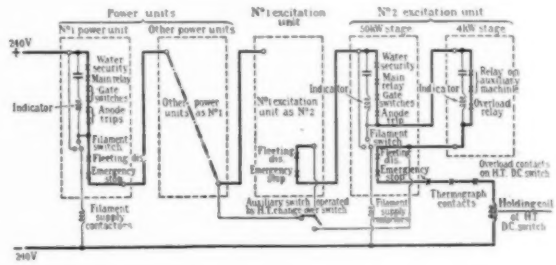


Fig. 8.—"Series" Control Circuit.

motor on the ground through the medium of a rubber motor-cycle belt. The motor is weather-proof and actuated by a Venner time switch.

High-Frequency Generating Valve Plant.—The aerial was designed so that it could be used as one large aerial or be readily divided and two separate down-leads were provided so that it could be used for simultaneous transmissions when necessary. However, it was decided to carry out experiments in transatlantic telephony in association with the American Telegraph and Telephone Co., and the smaller part of the aerial has been reserved for this purpose for the present. The primary source or master oscillator is a valve-maintained tuning-fork having a frequency of about 1,800 cycles per second (adjustable within small limits), and the high-frequency required for controlling the main set is obtained by selecting the 9th harmonic of the tuning-fork frequency. The frequency produced by this means is remarkably constant, the variation with temperature of the tuning fork being about 1 cycle in 10,000 per deg. C. A small adjustable electric heater enables the temperature of the box containing the tuning-fork to be kept constant. The output from the fork is of the order of micro-watts and is amplified once at low frequency. The 9th harmonic is then selected, filtered, and amplified three times with low-voltage valves, giving a final output of 100 watts from the last of these three stages. The tuning fork and all the above stages of amplification are contained in two copper boxes mounted one above the other, the various stages being screened from each other by copper partitions (fig. 6).

The output from the tuning-fork unit is amplified three times before it is delivered to the aerial circuit, the various stages being designed to deal with input powers of the order of 4 kW, 50 kW, and 1,000 kW respectively and giving output powers of 2 kW, 30 kW and 540 kW respectively. The combination of the 4-kW stage and its associated 50-kW stage forms an "excitation unit," which with the tuning-fork units are provided in duplicate.

The final stage of amplification (*i.e.*, the power units) is not in complete duplicate. The practice of having a number of units capable of being worked in parallel on common busbars has been adopted.

High-pressure D.C. Supply.—The excitation units and the power units utilise the same high voltage d.c. supply, which is switched on to the 4-kW stage, the 50-kW stage and whichever power units are in use, by the pressing of a single button on the control table.

Fig. 7 shows the circuit arrangements from the output of the tuning-fork unit to the aerial; the tuned high-frequency circuits are indicated by the thick lines and a particular characteristic is the use of a single tuned circuit between one stage of amplification and the next, and the use made of capacitative coupling for giving the necessary voltage variations on both anodes and grids. Some of the advantages of such capacitative couplings are:—(1) A condenser provides a low-impedance path for the harmonics necessarily generated by a valve transmitter when it is operated as an efficient power amplifier, and thus acts as a desirable harmonic filter; (2) the actual voltage-swings are easily and accurately calculable, both for design and during adjustment; (3) the power factor of a good condenser being very low, the voltage and current are practically in quadrature.

Three busbars run the length of the installation for the anode, grid, and filament (earthed) respectively, and to bring a particular unit into operation in parallel with others it is only necessary to connect it to the busbars by one 3-way switch, and the filament switch.

The 4-kW stage utilises glass valves of the so-called 600-watt type—*i.e.*, capable of a dissipation of 600 watts—and the panel can be equipped with 1, 2 or 3 such valves. The 50-kW stage utilises three water-cooled valves similar to those in the power units, and the coils forming the inductances of the high-frequency circuits of both stages are constructed of cable of insulated and stranded wires, wound on a framework of American whitewood in a similar manner to the large inductances described later. The cable of the 4-kW stage inductance is 243/36 S.W.G. and that of the 50-kW stage is 729/36 S.W.G. The condensers of these high-frequency circuits are mica condensers in oil. Associated with each excitation unit is one motor driving four generators, utilised for the following purposes:—(1) 500/1,500 volts, ¼ amp.; anode supply for various amplification stages of tuning-fork unit; (2) 15/20 volts, 60 amps.; filament supply for 4-kW stage, and also for tuning-fork unit by means of potentiometer; (3) 40/60 volts, 12 amps.; grid-bias voltage for power units; (4) 200/600 volts, 1.5 amps.; grid-bias voltage for 50-kW stage and also for 4-kW stage by means of potentiometer.

With such a chain of amplifiers one probable difficulty is the self-oscillation of the system in whole or part due to retroaction from the later to the earlier stages, but this tendency can be reduced by screening between the various stages.

Power Unit.—When the design for Rugby was prepared, the largest power valve commercially available which had been subjected to severe traffic tests was the Western Electric water-cooled valve which is capable of dealing with an input of 20 kW, of giving an output of 10 kW, and continuously dissipating 10 kW when operated at a d.c. anode voltage of 10,000 volts, the filament consumption being 41 amperes at 22 volts. All the valves used in the installation were manufactured by the Western Electric Co. at New Southgate, England.

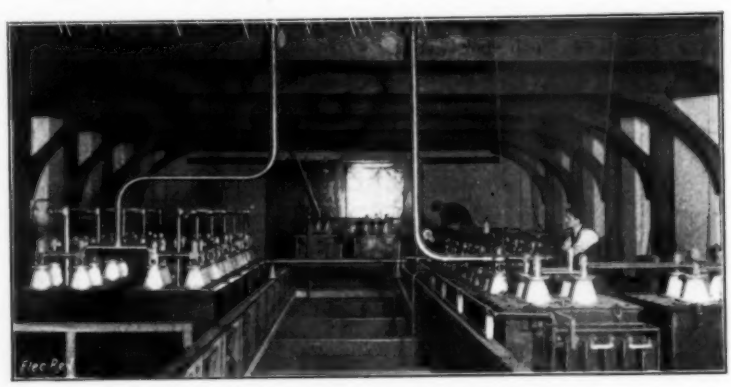


Fig. 9.—Main Condenser Banks in Intermediate Circuit.

An efficiency of the order of 95 per cent. can be expected from the coupled circuit to the antenna, which means that for an aerial power of 500 kW an output from the valves of about 520/530 kW is required. The determining factors in deciding the size and number of the power units were as follows:—(1) The number of valves in each unit should be preferably a multiple of 3 in order to permit the balancing of the filaments between the 3 phases; (2) the number of units must not be unduly large, in order to avoid complication of wiring and excessive duplication of meters, &c.; (3) the number of units should be sufficient to enable the number of valves in use to be varied in suitable steps (*a*) for the station to work on low power if this proves to be economically desirable, or (*b*) for the utilisation of a smaller number of greater power valves as the manufacturing technique of power valves develops; (4) the number of units should be suitable to provide two transmissions of the order of 300 kW aerial power and still leave a

spare unit. These considerations led to the decision to provide 5 power units, each capable of an output of 180 kW from 18 10-kW output water-cooled valves; 3 power units would be required for a 500-kW aerial power transmission, leaving two units spare; also two transmissions of over 300 kW aerial power could be undertaken by using two power units for each, leaving one unit as a spare in reserve. A power unit consisting of 18 valves is a rectangular enclosure with 9 valves on each side and the two anode panels are supported from the floor by 4 18-in. insulators that also supports the copper water pipes between these panels which not only act as headers for the water supply to the anodes but also as the anode busbars for the valves in the panel. In the event of any particular valve taking an excess current due to softness or any other reason, the corresponding relay operates, releasing a hammer normally held up by the armature of the relay which in turn operates a mechanism which trips the high-pressure d.c. switch by breaking the "holding coil" circuit.

The distilled water is supplied through 30 ft. of 2-in. diam. rubber hose wound on a horizontal wooden drum at the bottom of the power units. The long length of water in the rubber hose provides the necessary insulation of the anodes from the earthed metal parts of the water cooling system, and the drum carrying this hose is a part of the insulated anode system. The short lengths of rubber tube from the headers to the valves provide the insulation required between valves to permit the insertion of relays, coils, &c., in the individual valve anode circuits. The insulation of the anode system of one power unit under working conditions with water flowing is of the order of 520,000 ohms, giving a leakage current through the water at 10,000 volts of only 20 mA.

The Paralleling of Valves.—One of the difficulties is the tendency of the valves to "self-oscillate," individually, or in groups, the inter-electrode capacity of adjoining valves, or groups of valves, forming the condenser of the oscillating circuit in association with the inductance of the connecting leads, &c. These difficulties are increased with water-cooled valves where the existence of the water jacket increases the inter-valve and inter-electrode capacities very considerably. The system is made stable by one or more of the following devices:—(1) The provision of a small condenser between the grid and filament of each valve, as close to the electrodes as possible, in order to make the grid-filament impedance capacitative. (2) The use of "stopper" circuits in the individual anode, and/or grid circuits, consisting of an inductance in parallel with a resistance high compared with the impedance of the inductance at the transmitted frequency. For undesired oscillations, however, which are of a much higher frequency, the added inductance becomes a large proportion of the inductance of the circuit and the resistance across it provides sufficient damping for the conditions of self-oscillation of the valves to be unfulfilled (Western Electric Co.). (3) The insertion of a series resistance in the individual anode or/and grid circuits which acts as a damping for self-oscillation, but is not of high enough value to cause a large power loss at the transmitted frequency.

The paralleling of the power units themselves also involves consideration as to the method of prevention of inter-oscillation between power units.

At Rugby the combined anode of the power unit is fed to the main anode busbar through a "stopper" circuit consisting of an inductance of 100 μH in parallel with a resistance of morganite plates of 8.5 ohms. The combined grid of the power unit is fed to the main grid busbar through a "stopper" circuit consisting of an inductance of 50 μH in parallel with a resistance of 300 ohms formed by 6 straight-filament lamps in series.

Safety Devices.—Safety devices for the protection of the staff are provided. The protection of plant is of special importance, because the closing of the h.p. switch for a very short period under incorrect conditions might result in the destruction of a number of valves, and there is a possibility of valve failures which amount to a short-circuit of the 10,000-volt d.c. supply. All the safety devices and relays are therefore linked in one series circuit through the "holding" coil of the high-pressure d.c. switch. A disconnection in any one place will prevent the switch from being closed, and also the breaking of the circuit at any point during transmission due to a fault or an overload will open the switch. Fig. 8 is a skeleton diagram showing the circuit arrangement of this "series" control wiring.

(To be continued.)

The Electricity (Supply) Bill, 1926.

Some Authoritative Constructive Criticism.

THE following statement has been sent us by Mr. R. A. Chattock, president of the Institution of Electrical Engineers, and city electrical engineer, Birmingham:—

Since the Bill was published there has been a large amount of criticism from various points of view. Most of this has been destructive and will not, I think, help the Government to any great extent. It seems to me, therefore, desirable to try to put forward something constructive.

The Bill is designed to make the handling of electric current easier, to cheapen its production, and make it available throughout the country.

It is apparently the complaint of the Government that existing facilities have not done this, and that to this extent the present supply undertakings have failed. I think this complaint, if it is really justified, is due rather to the inefficient and hampering legislation in the past, than to the shortcomings of the undertakings.

There is no doubt that the existing machinery is cumbersome, and requires simplification. As an example, the Birmingham undertaking has waited for nine months for sanction to supply a rural district outside the Birmingham boundary. Doubtless other undertakings are hampered in the same way.

I feel that it is unfair to criticise the industry on this account. What is wanted is the provision of greater facilities to prevent these delays, and machinery to make easier and simpler the obtaining of wayleaves for overhead lines.

There is no indication in the Bill that the present hampering restrictions will be done away with. I am afraid that the establishment of the proposed Board will tend to make things still more difficult. It will, in fact, be the buffer between the industry and the Electricity Commissioners, and we can only anticipate a slowing-up of the present procedure when it is established.

The main duties of the proposed Board can apparently be divided into two sections:—

1. To control and cheapen the cost of generation.
2. To provide for main transmission throughout the country.

Considering the case of generation first, if we look at the large industrial centres which have already established highly efficient generating stations of large capacity, which stations would probably be "selected" by the new Board, it certainly does not appear that control of any such stations can materially affect the cost of producing electricity in them. It is only when we come to the large number of small generating stations throughout the country that improvement can be looked for.

If, therefore, the big stations in the industrial centres are allowed to develop on present lines, and if those undertakings are required to extend their stations, and, if necessary, build new ones in order to furnish a supply to very much larger areas, there does not seem to be any need to interfere with them so far as generation is concerned.

When we come to transmission, however, a different picture presents itself. The establishment of main transmission lines from the large industrial generating centres to the rural districts and the smaller towns in the country is work for which there is at present insufficient machinery set up.

Here is where a Central Board might do very valuable work. Powers could be given to it to purchase from the existing large centres what current it required for distribution, and to retail it in bulk to the distributing authorities outside those centres. Such current might be purchased at cost price and retailed at a price which would cover the cost of transmission and administration.

In this way the smaller undertakings would, in a very large number of cases, be placed in the position of obtaining their current at a cost cheaper than they could generate it at their own stations. When this happens it would be commercially sound for them to purchase what they require in bulk and eventually to close down their generating stations. Such procedure would not savour of coercion as is hinted at in the Bill.

This very process has been going on within the large industrial areas already. Birmingham has closed down four small generating stations, and it transmits current from its large generating stations to those centres from which it is distributed. This change has come gradually, and only when it has proved to be sound commercially.

It would be attractive to the large centres to sell current in this way, at cost price, as their turnover would be largely increased, and though their load factor would only be slightly improved, the fact of the larger turnover would really enable current to be produced more cheaply.

The stimulus of competition in low cost of production would also remain between different areas a most valuable asset. There would be no such incentive left under the scheme outlined in the Bill.

As regards the establishment of main interconnecting lines between large centres, I cannot see that the cost of this is justified. There will be sufficiently large generating stations in each area to justify coupling them up regionally, and the cost of doing this will be very much less than coupling up nationally. Ample spare plant to ensure reliability would be justified in each area amongst its own group of stations, and there should be no necessity whatever to draw current from other centres, perhaps a hundred miles away, at a much higher cost.

Development on these lines will render the standardisation of frequency unnecessary, while if current of standard frequency was required in an area which is at present non-standard, there would be no objection whatever to the installa-

tion of generating plant built for standard frequency in non-standard stations.

This plant would have the benefit of the high economy of the large station behind it, and any current produced by it would cost no more than the bulk of the current supplied from such a station.

There does not therefore appear to be any justification for an upheaval such as is proposed in the non-standard areas, at such a colossal cost as is indicated in the Bill.

I am convinced that the pooling of the load factors of different areas would make practically no improvement in the average load factor. I agree that this looks an attractive proposition, but it is, in my opinion, very questionable whether the diversity factor is really great enough to create any improvement.

The hours of employment in industry are practically identical in all areas, so that the power load would be demanded over identical periods each day. The habits of the residential population do not vary in different areas, their meal times, their hours of rising, and their times of retiring to rest are the same, and one cannot imagine that there would be any diversity here.

If an improvement in the average load factor is desired, I maintain that the railway system throughout the country should be electrified. If this were done, the load factor would be undoubtedly improved. The comparatively high load factor obtained on the North-East Coast is largely due to railway supply, whilst in America load factors of 40-45 per cent. are obtained, also due to railway electrification.

As regards week-end pooling of plant throughout the country, the large expenditure which would be required for the interconnecting lines would certainly not be justified by this. Regional week-end pooling in each area would provide all that is necessary for obtaining the highest economy of operation.

A very important consideration in connection with the proposed "Gridiron" is the danger of concentrating such an enormous capacity of plant on to one system. The tendency at the present time is to sectionalise the main system network more and more, partly to limit the effect of disturbances, and partly to enable the control switchgear to operate with certainty. Even at the present time the large size and capacity of the switches that have to be employed is increasing the cost of switchgear out of all proportion to the rest of the station.

I am convinced that we shall come to an arrangement in which each large generator will supply its own group of circuits, entirely distinct from any other. As the load falls off, generators will be paralleled, and the load transferred so as to keep those running on circuit properly loaded up.

In Birmingham, in order to provide the safeguards indicated above, the city has already been divided up into two sections, and further division is contemplated as the capacity increases. This has been found necessary on a system which at present has a total capacity of 140,000 kW.

In the Weir Report reference is made to the necessity for interconnection between areas, and in support of this (see Clause 25) Mr. S. Insull, President of the Commonwealth Edison Company of Chicago, stated in evidence that in his judgment any man who refuses interconnection (and he did not exclude England) does not understand the fundamental economies of the business.

I was very surprised to see this reference to Mr. Insull's evidence before the Weir Committee, because some two years ago several engineers, including Mr. Insull, Junior, from the Commonwealth Edison Company of Chicago, called on me in Birmingham and discussed a proposal to split up the high-tension system.

They informed me that they had suffered very serious interruptions due to disturbances which it was impossible to control owing to the enormous plant capacity that was grouped on to the interlinked system, and they were considering the question of sectionalising the system in order to limit the plant capacity of any one section.

Again, quite recently I received a communication from Mr. George A. Orrok, consulting engineer to the New York Edison Company, in which he stated that in the Hell Gate and Sherman Creek Stations in New York they are now isolating the large generators, each one being connected to a group of feeders in order to minimise the effect of disturbances that may occur.

Further, again, Mr. Alexander Dow, the President of the Detroit Edison Company, has published an article* in which he describes a method which he calls the "Loose Linking of Large Power Sources" in order to minimise system disturbances and reduce the duty on the circuit breakers without sacrificing flexibility and enonomy of operation. He states that continually increasing demands and generating capacity, together with the close knitting of the transmission system, forced them into adopting this method some years ago.

The service was becoming jeopardised by the amount of generating capacity behind the circuit breakers. The whole connected capacity was ever ready to spill an immense amount of energy into a fault whenever one developed. They could not allow conditions to continue that were favourable to system-wide disturbances. They have even applied this method to the two halves of one generating station.

Experience has shown that the tieing of sections together in this way does not require any greater reserve capacity of generating plant than in a system that is closely interconnected all the time.

In Mr. Dow's opinion, even if more reserve capacity were required, it is not so expensive to provide it by means of reserve generating plant capacity as by heavy tie lines between generating stations. In this way they have minimised the duty of circuit breakers, and consequently the possibility of failure and service interruption.

I therefore feel that a case has not been made out for pooling the generating resources in this country, but that very valuable results would be obtained by placing all main transmission lines and the purchase and sale of electricity passing through them in bulk in the hands of one, or possibly several, boards.

* See Elec. Rev., February 12th, 1926, page 269.—Eds.

British Plant in China.

Some Small Gas-Engine Electricity Generating Stations.

The British machinery market in China has held its own from the beginning. Numerous steam power plants for electricity supply have been installed in the provinces, ranging from the huge 20,000-kW Parsons and Metropolitan-Vickers turbo sets in the Shanghai Municipal Electricity Department, to the small home-lighting sets found in the small towns; yet the introduction of gas-engine plant is a recent event, dating back only a score of years. A typical installation of such a plant is that of the Kiangwan Electric Light Co., Ltd., Kiangsu, a description of which may prove of interest as the equipment is all British.

The town Kiangwan is only four miles north of Shanghai and is situated on the Shanghai-Woosung branch of the Shanghai-Nanking Railway, so that the transportation problem is not so difficult as is experienced in the interior. The company had three vertical hot-bulb oil engines of Continental make in the early stage of its development, but with the growth in the demand it was decided to increase the plant capacity by two 100-kW gas-engine sets. As an emergency measure to meet the demand pending the arrival of the machinery, the company obtained from local stock one "Mirrlees-Diesel" vertical, single-cylinder, open-type engine, 50 h.p., 250 r.p.m., to drive an International G.E.C. 40-kVA alternator, a small petrol engine compressor being used for charging the air bottles. The two gas-engine plants were erected during the summer of 1922, when one set arrived about a month prior to the second one, thus enabling the engineer to supervise their erection separately. The engines were manufactured by the National Gas Engine Co., Ltd., and are of the twin-cylinder horizontal type, each developing 150 b.h.p., at 210 r.p.m. They run on producer gas, suction-gas plant having been supplied by the makers of the engines; anthracite is used as fuel. Each gas engine belt drives a 127-kVA alternator, 3-phase, 50 periods, 2,400 V, 750 r.p.m., directly coupled to an exciter, manufactured by Messrs. Bruce Peebles & Co., Ltd.

The switchboard was supplied by Messrs. Whipp & Bourne, Ltd.; it is of the open type, consisting of four panels, excluding the feeder and exciter panels. The oil switches, made by Messrs. Erskine, Heap & Co., Ltd., are fitted with overload and no-volt trips. Synchronising equipment is provided, but the alternators are running on separate circuits and are therefore not required in parallel. Other electrical apparatus like distributing panels, transformers, and protective gears, are native made, but large quantities of cables and wires were supplied by Messrs. W. T. Henley's Telegraph Works Co., Ltd. The erection was carried out by native engineers and labourers under the supervision of Mr. R. A. E. Denton, of the British Electrical and Engineering Co. of China, Ltd., Shanghai, who supervised the Diesel-engine erection also. The plant has been running since it was first put down and the repair costs have been negligible.

A similar 127-kVA set is installed in the city of Tatung, on the Yangtse River in the Kiangsi Province, and another gas-engine installation is to be found in the works of the Yangchow Electric Light and Power Co., Ltd., Yangchow, Kiangsu Province. The latter consists of a direct-coupled vertical engine alternator set. The engine, also made by the National Gas Engine Co., Ltd., is of the six-cylinder, three-crank, tandem type developing 450 b.h.p. at 300 r.p.m., with anthracite suction gas-producer plant. The alternator is of Messrs. Mather & Platt's manufacture, and is rated at 300 kW, 0.8 power factor, 2,300 V, 50 periods, 3-phase. The switchgear was supplied by Messrs. Erskine, Heap & Co., Ltd. The set was installed by the Jardine Engineering Corporation, of Shanghai, in 1924, and has given every satisfaction.

At the present time crude-oil engines are more favourably considered in China than gas engines. British plant is still prominent on the market, though the prices are not very competitive with those of the Germans.

Swiss Electric Locomotives.—Work is in hand at the works of the Sécheron Co. at Geneva on the electrical equipment of four locomotives which, it is claimed, will be the most powerful in the world. The engines, which are intended for service on the Lotschberg mountain railway, are being provided with six 700-h.p. motors, and are intended for the haulage of trains for which two engines have hitherto been required. The locomotives have nine axles, and are 82 ft. in length.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

The Guildford Corporation Bill.—The clauses in this Bill by which the Guildford Corporation seeks power to sell electrical fittings and wiring, and to open showrooms, were considered by Section A of the Local Legislation Committee of the House of Commons last week. As in the case of the Colwyn Bay and Doncaster Bills, there was opposition from the local contractors.

Mr. W. J. JEEVES, K.C. (who appeared with Mr. Rowand Harker, K.C., for the Corporation), said that the electricity undertaking at Guildford was acquired by agreement in 1921. Since the Corporation had acquired the undertaking the consumption of electricity had been more than doubled, and the price reduced by 32½ per cent. In view of that record, he was confident that the Committee would agree that the Corporation could be trusted to conduct the undertaking in the best interests of the consumers. The erection of a new generating station was contemplated, because the present station was working almost to its full capacity, and the area of supply had been increased. The great majority of the houses in Guildford were of the small type, and the present position was that if the occupier of a house could not put down in a lump sum the price of his installation, he could only hire it and pay a rental for all time, and had no opportunity to buy it. The contractors in Guildford had done nothing to increase the consumption of electricity in the town. Their view, that the exercise by the Corporation of the powers asked for would drive them out of business, was an entire misconception, because the contractors would get more work than at present, as was shown by the results achieved in other towns.

Mr. W. E. AFFLECK (the electrical engineer to the Corporation) was the first witness. He was cross-examined by Mr. Craig Henderson, K.C. (who appeared with Mr. M. N. Drucquer for the contractors). Following a statement by the witness that one of the main reasons why he wanted selling powers was that he wished to develop electric cooking and sell cookers on the deferred-payment system, Counsel urged that the Corporation could develop electric cooking just as well by means of simple hire, under its existing powers, and suggested that in its present stage the electric cooker was liable to become obsolete at a not very distant date, so that the wise man would hire rather than purchase a cooker. Witness disagreed with this view, and said that there were a number of people in Guildford who were anxious to purchase electric cookers by the deferred-payment system. The large majority of contractors in Guildford were inefficient. If the Corporation had wiring and selling powers, it could carry out wiring as well as it could be carried out by the few first-class contractors there, and probably cheaper than one or two of them.

Discussion then turned upon the desirability or otherwise of the Corporation being bound to carry out wiring through the contractors. Witness objected to this, however, on the ground that the Corporation would have to finance the contractors, who stood to gain everything and to lose nothing. He said that his charge for wiring would be as near cost as possible. Counsel said that that would make it impossible for the contractors to compete. It was suggested by the Chairman that, in the event of wiring and selling powers being granted to the Corporation, it should exercise caution, and obtain quotations from contractors for the equipment of houses of various sizes before establishing its own wiring department. Witness was confident, however, that he could keep a staff of ten wiremen continuously employed for a good many years to come, and said that he would not recommend his Committee to establish a showroom and launch a big development campaign without the powers to wire and sell.

Mr. J. B. RAPKINS (Mayor of Guildford, and chairman of the Electricity Committee) gave evidence, and attributed the increased consumption of electricity in Guildford mainly to the facts that the Corporation had improved the efficiency of the works and had decreased the price. He said that it was necessary that the wiring should be carried out by the Corporation rather than by the contractors under Corporation supervision. Counsel held, however, that it was merely a matter of preference; the contractors had no objection to supervision. As to the suggestion that the contractors had done nothing to help the development of electricity, Counsel said that the Corporation had not encouraged them to do so.

Mr. L. L. ROBINSON (Borough Electrical Engineer, Hackney) spoke of the results achieved in Hackney, where the Borough Council had possessed wiring and selling powers since 1906, and said that the exercise of those powers had been beneficial to contractors, the Borough Council and the consumers alike. As evidence that the exercise of those powers had not injuriously affected the contractors, he said that during the last year 296 installations had been executed by the Borough Council's workmen; 98 had been executed by contractors to the order of the Borough Council; 378 were executed directly for the consumers by local contractors; and 491 directly for the consumers by contractors whose business premises were outside the Borough Council's area. A very large number of those orders had originated from the canvassing work of the Borough Council. His experience was that most of the contractors were in a small way of business and could not do much canvassing; also, they did not put forward hire-purchase systems. He did not think many contractors charged less than cost plus 35 per cent. for installations, "cost" being labour and materials. It was suggested by Mr. Craig Henderson, in cross-examination, that the best work was done by contractors in Hackney on the basis of 20 per cent. on cost, this including overhead charges. Witness said that that was not his experience.

Mr. W. FINLAY (secretary and solicitor to the Electrical Contractors' Association of Scotland) was the first witness on behalf of the opposition, and spoke of the excellent results accruing from the co-operation of the supply authorities and contractors in Glasgow and Edinburgh. He agreed that it was wiser to hire an electric cooker than to buy it at the present time, in view of the possibility of obsolescence, but added that the charge for energy for heating and cooking in Guildford to-day was 2½d. per kWh, at which price it was not a practical proposition. He had visited Guildford, and had found that at least three of the contractors there had up-to-date showrooms. Cross-examining, Mr. Jeeves pointed out that the prices which were charged in Glasgow for installations were prices which were settled by the Glasgow Corporation and the contractors in consultation, and Glasgow was able to work such an arrangement because the Corporation had powers to execute the work itself. In Edinburgh, however, the Corporation had not those powers, and he suggested that that was the reason why there was no controlled schedule of prices there. Witness replied that there was no necessity for a controlled schedule of prices in Edinburgh, because the Corporation did not sell installations and had not yet started hiring them. It was put to the witness by Mr. Jeeves that there was no reason why the Guildford Corporation should not co-operate with the contractors if granted wiring and selling powers, but witness pointed to the statement of Mr. Affleck, that he proposed to charge a price for installation work which was as near cost as possible. The Chairman said that the only point at issue was that the wiring should be done through the contractors. He pointed out, however, that the Corporation had to find the money, and had to take the risk involved in maintenance, which was important. He asked why contractors should not guarantee the efficiency of installations or apparatus which they supplied during the period covered by the deferred payments. Witness replied that an apparatus or installation might fail in a short time owing to abuse by the user, but if it failed because the installation was bad in the first place, then it was the fault of the person who had inspected it on behalf of the Corporation.

Mr. T. E. ALGER (president of the Electrical Contractors' Association) said that the Association did not object to hire purchase so long as the wiring was carried out by the contractors, and that the Association had no part in the control of prices.

Mr. W. J. BROWN (of Messrs. Tiley & Brown, electrical contractors, Guildford) said there were eight *bona-fide* contractors in Guildford—and that was a conservative estimate—with permanent staffs numbering about 64. There were sufficient firms of standing to carry out the whole of the wiring required there. He welcomed supervision of his work by the Corporation. He agreed that his firm were also ironmongers and general engineers, and that electrical contracting constituted the smaller part of the business. He believed that none of the contractors in Guildford had offered publicly to wire houses on the hire-purchase system, and in his view it was not a commercial proposition.

Mr. CRAIG HENDERSON, in his summing up, urged the view that the question under discussion was one which should be settled by Public Act. The general law did not confer upon municipal electrical authorities the powers which were now asked for by the Guildford Corporation, and a special case had to be shown before the general law could be extended to them. No special circumstances had been put forward, however, with regard to Guildford, and it had been admitted by Mr. Affleck that there were electrical contractors there who were competent to carry out the necessary installation work, as well and as cheaply as he could do it. There was no case for the granting of selling powers, but, if they were granted, they should be limited to genuine hire-purchase.

Mr. JEEVES (for the Corporation) adopted the argument that Mr. Craig Henderson's remarks constituted a plea for the continuation of the middle-man, which must inevitably result in increasing the price to the consumer. But if the powers were granted, the middle-man would not be eliminated, and he would still have a chance to compete. It was unreasonable that the Corporation should go to the expense of providing a showroom and of canvassing, but should not be allowed to reap the benefit.

The CHAIRMAN, in announcing that the Committee had decided to grant the powers, said that the evidence had led it to the conclusion that the provision of electrical installations in small property by means of a system of deferred payments had been very successful. The Committee felt that the Corporation should "go slow" in this matter and seriously consider every move in the interests of the consumers. Where there were reputable wiring firms, upon whom it could rely to do good work at reasonable prices, it would do well to employ them and to seek their co-operation. Also, whatever staff the Corporation employed in the exercise of the powers should be fully occupied, in order to avoid waste and increased costs. The powers would also enable the Corporation to protect itself against high prices.

Mr. JEEVES intimated that the policy which the Committee had advocated would be the policy which would appeal to the Corporation, and Mr. DRUCQUER intimated that the contractors would do their best to co-operate loyally with the Corporation.

Trans-Atlantic Telephonic Communication.—On April 20th, Sir H. BRITTAIN asked the Postmaster-General whether, following the recent successful trans-Atlantic telephonic communications, any further developments were taking place.

Sir W. Mitchell-Thomson said that he was not in a position to give the House any further information with regard to those tests at present. Experiments continued to be conducted with a view to solving the numerous technical difficulties involved in simultaneous two-way radio-telephone transmission where land telephone lines must be associated with the radio link at both the transmitting and receiving ends.

Bristol Corporation Scheme.—On April 20th, Colonel Woodcock asked the Minister of Transport whether it was the intention of the Electricity Commissioners to withhold permission to the Bristol Corporation to proceed with its power station at Portishead until such time as the Electricity (Supply) Bill had been placed upon the Statute Book.

Colonel Ashley said he understood that the Electricity Commissioners did not propose to come to a decision on the point until Parliament had considered the Bristol Corporation Bill, but it might not be necessary to defer the consideration of this matter as suggested.

Smoke Abatement.—In the House of Lords, on April 22nd, during the Committee stage of the Smoke Abatement Bill, Earl De La Warr moved the insertion of the following new clause:—"It shall be the duty of a local authority on submitting proposals for the provision of houses for the purposes of the Housing Acts, 1890 to 1924, to satisfy the Minister that suitable arrangements are to be made for heating and cooking as are calculated to prevent or reduce the emission of smoke."

Viscount Gage, resisting the amendment on behalf of the Government, said that the Minister of Health was opposed on principle both to placing restrictions on the discretion of local authorities, and to attempting to interfere with the ordinary domestic habits of the people, except where it could be clearly shown that such action was necessary. Very great progress had already been effected without compulsory measures in connection with housing schemes in the substitution of gas for coal for cooking. Numerous examples also existed where electricity had been installed as the lighting and cooking agent, and experiments with all-electric houses were being tried on a considerable scale by several local authorities.

Lord Newton said that new housing estates were being put up all over the country, and it would be a crime if when public money was spent on such places they should be allowed to defile the atmosphere with their old-fashioned methods of heating and cooking.

Lord Banbury held that both gas fires and electric heaters were very expensive, and to pass the clause would add to the cost of the new houses.

The new clause was rejected by 40 votes to 8.

Power-Station Engineers.—On April 26th, Mr. Hore-Belisha asked the Prime Minister, whether he had received a letter from the Executive Council of the Electrical Power Engineers' Association pointing out the hardship which accrued to power station engineers, in view of the operation of Admiralty Order C.E. 194/25, whereby, although their responsibilities remained the same, they had been reverted to the minimum of the scale for their grade, resulting in many cases in a financial loss of £50 a year plus the appropriate bonus; and whether it was proposed to remove the grievance brought about by the operation of this regulation.

Mr. Davidson said that the matter referred to had recently been under consideration and a favourable decision had now been reached. This fact had been communicated to the Electrical Power Engineers' Association.

The Budget.—The Chancellor of the Exchequer introduced his "Budget" for 1926-27 on April 26th. No proposals of a revolutionary nature affecting business were put forward, but the following will have a bearing on business:—The assessment of income tax on a three-years' average is to be abolished in favour of assessment in respect of the preceding year, commencing in 1927; it is not proposed to renew the Trades Facilities Act next year; the import duty on arc lamp carbons is to be raised to 1s. per lb.; and the Key Industry Duty is to be extended, until 1936, to cover component parts of scientific instruments and amorphous carbon electrodes, not including primary battery or arc lamp carbons, at a rate of 33⅓ per cent. *ad valorem*. The tax on electric vehicles is to remain unchanged at £6 per annum.

Legal.

Cable Engineer Sent to Prison.

At Garstang Police Court, on April 22nd, Gerald S. Race, of Knott End, was charged with stealing £63 belonging to the Pirelli-General Cable Co., Ltd., of Southampton, which recently carried out a contract in the Preesall district. It was stated that prisoner took up the position of chief engineer in January last, and he had control of the work. Each week he had to send the firm a requisition for wages, &c., and received the necessary cheque. From January 1st to March 26th he requisitioned £1,235, and he disbursed £1,197, leaving a balance in hand. The company also sent him during the same period £25 for insurance stamps. The cards, however, had not been stamped and prisoner was subsequently arrested in Ireland. Mr. T. W. Busby, assistant contract manager to the company, said that prisoner's wages were £5 10s. per week.

Prisoner was also charged with obtaining money by false pretences from A. Parkinson, taxi proprietor, Knott End. The allegation was that prisoner ran up a bill of £7 for taxi fares, and also obtained £7 from Mr. Parkinson. He made out a cheque for £14, but this was dishonoured by the bank.

Prisoner said if the Court would give him another chance to make good, he would take advantage of it. He was sent to prison for one month, in the second division.

Claim for a Dynamo.

At Burnley County Court, on April 22nd, Messrs. George Mitchell & Co., electrical engineers, Burnley, sued W. Eccles, junr., electrical power and lighting engineer, Blackburn, for £43 10s. Plaintiffs claimed that they had supplied a second-hand dynamo to the following specification: 220 V, 800 r.p.m., and from 9 to 10 kW.

Defendant alleged that the machine was not up to its reputed capacity, and that the insulation was defective at the time of delivery.

The Judge found for defendant, stating that the plaintiffs had not carried out tests to support their claim that the dynamo was of the character claimed for it.

Richmond E.L. & P. Co.'s Pension Fund.

Mr. Justice Romer, in the Chancery Division on April 20th, heard a petition for the alteration of the objects in the memorandum and articles of association of the Richmond (Surrey) Electric Light & Power Co., Ltd.

Mr. Uthwatt, for the company, said the object was to give the company power to set up a pension fund for its employés.

His Lordship said he did not like the unrestricted power given in the proposed alteration under the head of "charitable objects." He thought it should be limited to objects directly or indirectly for the benefit of the company. With this amendment he confirmed the petition.

A Bankruptcy Offence.

After a trial lasting two days, the hearing was concluded at the Central Criminal Court, on April 23rd, of the case against William Henry Pease (39), an engineer, of Abbey House, Victoria Street, S.W.1, who surrendered to his bail and pleaded "not guilty" to an indictment which charged him with obtaining credit without disclosing the fact that he was an undischarged bankrupt. He was found guilty, and the Judge passed sentence of three months' imprisonment in the second division.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Heating of Buried Cables—Report No. 2.

There would appear to be a serious slip in the formula published in the above report relating to the temperature rise in three-core cables, and as the report itself is such an invaluable document and basis of reference, and I cannot find any corrections publicly attached to the report, it seems to be in the interest of the electrical profession, more particularly of those engineers, who, like myself, are not connected with cable manufacturing firms, that the correction should, as early as possible, be given sufficient publicity to save others from having to repeat the investigation which I have had to do to discover the source of the error. (Of course I know that in the case of the big cable manufacturing firms, who have had representatives on the Standardising Committee, the information conveyed in his letter has no doubt been imparted verbally to their staffs.)

Put very briefly, the trouble is as follows:—

The value of the resistivity "K," if calculated from equation (25) on page 534 of the *Journal* of the Institution of Electrical Engineers for May, 1923, will give results which are 300 per cent. too high.

If, then, one were to put this value obtained for "K" into equation No. 33 in order to obtain the value for "S" (the thermal resistance per unit length), one again gets results 300 per cent. too high.

The same remark applies more or less to equations 15, 18, 26, 29, 42, 44, 48 and 52.

Again, in equation (58), in the first term of the denominator, a symbol (r_s) is given, which would appear to be the resistance of one of the cores of the cable, but which is stated on page 566 to be the "inner radius of the containing tube."

Also equation (37) contains a printer's error. Finally, it may be mentioned that the definition of (H) as given at the top of page 521, is involved in equation (25).

The writer may say that equation (25) is correctly given in Report No. 1 (see page 196 of the *Journal* of the I.E.E. for February, 1921), and he has had occasion several times to use the formulæ give on this page and therefore did not notice until quite recently the discrepancy between this formula and that given in Report No. 2.

What is, however, common knowledge to those who are daily getting out thermal resistances of cables is not necessarily the same thing to those who have only occasionally to use such formulæ, and naturally would refer to a report like the one quoted as the last word on the subject.

I fully appreciate the immense labour which must have been entailed in putting together all the information in the report and checking it while it was yet in the manuscript form, but I cannot understand why no "errata" slip was attached

to the report to prevent the uninitiated from falling into the trap.

I feel that an apology is due to Mr. Melsom for publishing this information without first consulting him, but as he is over in America and as it seems of importance, as early as possible, to take steps which will save others from wasting precious time in trying to reconcile these formulæ, I hope he will excuse the irregularity.

No one appreciates more than I do the colossal nature of the work which he has carried through, and it is with the greatest diffidence that I make the suggestion of inaccuracy in equation (25) conveyed in the present letter.

A. M. Taylor,
Major S.O.2.

Birmingham, *April 20th*, 1926.

Electricity Supply Data.

I have read with interest your article on the above subject in the issue of April 16th, but venture to suggest that the *Electrical World* is not an authority of sufficient infallibility to permit the conclusions you derive from examination of its data. I find, for example, that the statistics of output of electricity as given by it differ materially from those published by the U.S. Geological Survey. The following table illustrates the position fairly clearly.

The Production of Electricity in U.S.A.
(Millions of Units).

Year.	Electrical World.	U.S. Geological Survey.	Difference.
1924 ...	54,413	59,013	4,600
1925 ...	59,517	65,408	5,891

The difference in the two sets of figures is sufficient, I think, to weaken some part of the case you put forward in your article. The only true comparison lies in the output of electricity from all undertakings in Britain as given in the fuel consumption returns of the Electricity Commission and the output as given by the U.S. Geological Survey.

For the year April 1st, 1924-March 31st, 1925, the British figures are 7,415 million units and the U.S. figures 60,371 million units, equivalent respectively to 175 units and 525 units (working on 42.5 million population in Britain and 115 million in U.S.A.). The American output is, therefore, three times the British per head of population.

I would venture also to question the percentage of units sold to units generated used in calculating consumption in the United States, namely, 81 per cent. In view of the fact that the British figure is 83 per cent., it seems very low. I find it also difficult to believe that " the central-station industrial field as it exists to-day is only 37 per cent. developed " in the United States, when the article states that American industry is 65 per cent. electrified, and that the output from private industrial plant aggregates 12,000 million units. According to the *Electrical World*, the total energy sold by central stations for power purposes in 1925 amounted to 27,867 million units. Assuming that 85 per cent. of this went into industrial consumption, the total would be 23,700 million units. The total capacity of power plant used in manufacture in the U.S.A. was, in 1924, 24,600,000 kilowatts and 37 per cent. of this would be 9,100,000 kilowatts. We are led to believe, therefore, that the total of 23,700 million units was consumed by 9,100,000 kilowatts or 2,600 units per kilowatt. The actual figure as calculated from the statistics given on page 45 is 1,600 units per kilowatt. The discrepancy between those figures requires explanation before we can believe that the central station industrial field is only 37 per cent. developed in the United States.

According to the U.S. Geological Survey, the increase in the output of electricity between 1920 and 1925 was 51 per cent., while the ratio of waterpower to the total output fell from 37.5 per cent. in 1919 to 34 per cent. in 1925, and will probably continue to decline. The comparisons given in the first paragraph of your article, in addition to being very much in the nature of special pleading in favour of this country, suffer from the fact that the 6,000 light and power systems mentioned for the U.S.A. do not represent 6,000 different administrations and cannot be compared with the 595 undertakings in Britain. Until we know the degree of amalgamation and centralisation of administration existing in the United States and in Britain, such a comparison is scarcely justifiable. In addition to this, the 584 stations listed for Britain include stations owned by non-statutory undertakings.

Hugh Quigley.

London, *April 19th*, 1926.

[We refer to this subject in our leading columns.—Eds. Elec. Rev.]

Three-phase, Four-wire Distribution.

In reply to " Inquirer's " queries in your current issue, I would advise him that there is no marked variation of pressure on a three-phase, four-wire supply when a three-phase star/star-connected, core-type transformer supplies unbalanced loads from each line to neutral, provided the unbalancing is not too great. The total out-of-balance current may be as high as approximately 20 per cent. of the normal full-load current without the phase pressures dropping by more than 2 per cent. Three-phase groups of single-phase transformers should, however, on no account be star/star connected for supplying three-phase, four-wire unbalanced loads.

It is certainly possible to operate a star/star-connected, three-phase, core-type transformer to supply a single-phase load should one of the transformer windings become defective, but on the other hand, transformer failures represent so small a percentage of the total number of transformers installed, that, in my opinion, this advantage should not be given undue prominence. If the unbalanced load is likely to exceed 20 per cent. of the normal full load of the transformer, it would be better to install delta/star-connected, three-phase, core-type units, and in practice probably 90 per cent. of the number of transformers installed are so connected. " Inquirer " will find fuller information concerning the points he has raised in the " J. & P. Transformer Book."

S. Austen Stigant,
Manager, Transformer Dept.,
Johnson & Phillips, Ltd.

London, *April 26th*, 1926.

Electric Vacuum Cleaners.

I appreciate Mr. Sacré's kind comments on what he is good enough to call the usefulness of my article on " Electric Vacuum Cleaners," while I do not agree with all his contentions. However, I agree strongly that salesmen do harm to their industry when they disparage competitive types of machine.

I agree that a very high-speed rotating brush probably damages a carpet as much as an excessive suction. However, I do not think a fixed brush in front of the suction orifice can be as effective as a rotary brush. It appears to me that the fixed brush must drive the dust straight up in the air in front of the machine and out of reach of the suction. Surely, the main purpose of combining brush and suction is to loosen the dirt and then suck it up.

For this reason I feel that the ideal machine is one that incorporates adequately powerful suction and a low-speed brush which does not damage the carpet any more than a fixed brush does, and operates more efficiently. The type of machine I am considering is the Standard (Western Electric), Premier Duplex, Hamilton Beach and Hoover, although I think the last mentioned has too small a suction and too high a brush speed. The secret of efficient design is to provide a high gear ratio between motor (*i.e.*, fan) speed and brush speed, so that the fan secures powerful suction and the brush rotates comparatively slowly.

As to the advantage of being able to fix on a stiff brush when required, this does not compare favourably with the most cleverly designed machine I know, which, besides having a geared, low-speed brush, has a switch for cutting the brush out of action when it is not required and the extension tools are being used.

My flour test is, as Mr. Sacré infers, a " sticky " one, both literally and metaphorically, but this is a severe test to bring out the abilities of only the best machines.

I disagree with Mr. Sacré's assertion that the " bag " type of machine is unhealthy or that it lets dirt get back into the room. I have never known this occur, and he must have run across a cheap machine with a badly made bag. Since reading his reply, I have made a careful test on two different types of machine, running them both over dirty carpets, and at the same time applying moistened, white, blotting paper all over the outside of the inflated bags for some time. The bags were found to contain considerable dirt, but the damp blotting paper showed not the slightest trace of dust or dirt. I think this test proves conclusively that a properly made bag is perfectly dust-tight and healthy. But even if the bag is placed in a cylinder, as Mr. Sacré prefers, surely air must come out of the bag in the cylinder just as out of a bag anywhere else, to allow a proper suction to be maintained. The bag is still the deciding factor.

Since no dust gets back into the room, I do not see the value of a disinfecting pad applied to dust-free air.

Replying to Mr. Sacré's question about adequate suction, I consider that a manometer should register between 14 and 16 inches on a properly designed machine at the fan chamber opening, with the bag on and the brush rotating. A new machine which has not been " run in " and is a bit stiff should never reach less than 12 inches.

A. G. Harrison Dent.

London, *April 26th*, 1926.

I have read with interest Mr. H. Harrison Dent's article in your issue of April 16th, and it is quite clear that he looks upon a vacuum " sweeper," as he calls it, as an article largely for carpet cleaning; but why cleaning should be so confined to carpets it is difficult to follow. Upholstered furniture, curtains, &c., all absorb dust and require almost as much cleaning as a carpet, and the demand is growing for an outfit with an all-round cleaning capacity, more mobile and easier to use than the ordinary vacuum sweeper.

Admittedly the vacuum sweeper has attachments for general cleaning purposes, but as Mr. Dent points out, suction is of special importance when using these attachments, and as the brush type of carpet sweeper (the type Mr. Dent seems to prefer) generally has a comparatively low suction, these attachments are of little or no value and are seldom, if ever, used.

The main point a user has to decide is whether a " carpet sweeper " is required or an all-round cleaning outfit, and it will be found that with the education the householder is receiving on this subject the all-round machine is preferred. The development of the enclosed-bag-type cleaner on wheels or

sleigh with its easy work and wide range of use has been brought about by the increasing demand.

Mr. Dent states that in his view a vacuum cleaner with a revolving brush is best for cleaning carpets. It therefore seems clear to me that Mr. Dent has not had the same amount of experience with the more modern types of domestic cleaning outfits fitted with the enclosed bag. These are suction-type machines, and have no mechanical devices to assist in the cleaning process, and I have had it proved to me many times that this type of suction machine will clean carpets quite as well as the other type referred to. The great popularity which the enclosed-bag-type suction machine has attained, testifies to the satisfactory character of the service it gives.

H. F. Simon, A.M.I.E.E.

London, *April 23rd*, 1926.

Overhead Transmission Lines.

I am sure interested readers of the Electrical Review will greatly appreciate Mr. Nelson's letter in last week's issue. I have myself found this gentleman's words true as regards rusty ironwork and bolts on pole fittings. While rustless steel or iron channel arms would certainly solve the main problem, may I make a further suggestion regarding bolts, insulator pins, bracings, and stay threads? If, when a transmission line is first erected, all such fittings mentioned above are coated with a solution composed of tar, tallow, and pitch carefully mixed together and applied with a brush, it will be found that the threads are rustless at all times. The tar itself acts as a waterproof liquid for mixing purposes, while tallow acts as grease on the threads, and pitch has always been used for warding off dampness from electrical fittings. May I say as a linesman with erection and maintenance experience that I have found the above method quite satisfactory and used to-day by some of our best mains contractors. I hope to read further suggestions that might greatly help in future developments in this particular section.

M. Simpson.

Leamington Spa, *April 26th*, 1926.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 21st :—

Magnet and Wire (design only). No. 465,650. All goods in Class 5. No. 465,651. Class 6. Machinery of all kinds. No. 465,652. Class 8. Instruments and apparatus for radio-telephony. No. 465,653. Class 13. Incandescent lamps (ordinary). No. 465,654. Class 15. Shades, globes, and reflectors made of glass. No. 465,655. Class 16. Electric insulating materials made of earthenware and porcelain. No. 465,656. Class 18. Electric alarms, signals, &c., as systems in buildings. No. 134,559. Class 25. Cotton-covered wire. No. 465,657. Class 32. Silk-covered wire. No. 465,658. Class 40. India-rubber-covered wire. Magnet No. 465,642. Class 6. Machinery of all kinds. No. 465,643. Class 8. Instruments and apparatus for use in radio-telephony and not consisting of or containing magnets. No. 465,644. Class 13. Incandescent electric lamps (ordinary). No. 465,645. Class 15. Shades, globes and reflectors made of glass. No. 465,646. Class 16. Electric insulating materials made of earthenware or porcelain.—General Electric Co., Ltd.

Parlophone, No. 465,325, and Parlaphone, No. 465,326. All goods in Class 8. —The Parlophone Co., Ltd., 1, Broad Street Place, E.C.2.

Hart. No. 467,914. Class 8. Electric secondary batteries and parts thereof. —Hart Accumulator Co., Ltd.

Sistoflex. No. 462,595. Class 50. Electrical insulating substances made of asbestos, mica, resin, oils, or bitumen.—Spicers, Ltd., 19, New Bridge Street, E.C.4.

Correction.—One of the notices appearing in our last issue referred to the Magnet Engineering Co., Birmingham. This firm is at Liverpool. Application No. 444,263 is in respect of "electric switches (not containing a magnet)."

A New Electric Signalling Installation.—According to the *Electrical World*, a stretch of 226 miles of double track on the Union Pacific Railroad from Cheyenne, Wyo., to North Platte, Neb., has been equipped with a new inductive type of signalling equipment, which is considered a marked improvement over the complete block system. A total of 131 locomotives have been equipped to operate in conjunction with the new system, the locomotive equipment including a 32/350-V, d.c. motor generator, the current of which is cut down and changed by amplifiers. A transmission line parallel with the track is employed, and energy is transmitted at 2,300 V, a.c., from the plant of the Cheyenne Light, Fuel & Power Company and the central stations at Kimball, Sidney and North Platte, Neb. Two sets of transformers are employed, the first reducing the pressure to 110 V and the other to 1½ and 3¼ V at the rails. The combination of the track current with the current generated on the locomotive operates the control lights in the engine cab—green for "clear" and red for "slow down." When the green is showing, the engine progresses at schedule speed; when red shows, it indicates a train or car on the track in the block ahead. A limited time is permitted for the reduction of speed to 20 miles an hour, and if this is not accomplished by the engineer, an automatic application of air to the brakes will result. Since the new system was first started eight months ago more than 11,000 engine movements have been recorded in the division mentioned without any difficulties being experienced. The equipment was manufactured by the Union Switch & Signal Company and is of the two-speed continuous inductive type.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

28,649. "Inductance coils for use in connection with radio apparatus." Igranic Electric Co., Ltd., and S. R. Wright. August 27th, 1925. (249,902.)

31,205. "Sound amplifiers." T. Young. December 30th, 1924. (Cognate application 12,275/25.) (249,918.)

31,215. "Electric gas-filled discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 25th, 1924. (236,155.)

1925.

387. "Equipotential cathode tube." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). January 6th, 1925. (249,939.)

680. "Variometers for wireless receiving apparatus and such like." W. Leigh. January 9th, 1925. (249,943.)

863. "Thermionic valves." H. L. Crowther and N. F. S. Hecht. January 10th, 1925. (249,948.)

1,127. "Electric resistances." H. B. Prentice. January 14th, 1925. (249,951.)

1,495. "Voltmeters." H. Butler and A. Chinn. January 17th, 1925. (249,954.)

1,919. "Electrical junction boxes and the like." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. January 22nd, 1925. (249,957.)

1,964. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. January 22nd, 1925. (249,958.)

2,524. "Electric switches." British Thomson-Houston Co., Ltd., and H. Trencham. January 29th, 1925. (249,962.)

2,822. "Mounting of cartridge-type fuses." English Electric Co., Ltd., and A. M. Pooley. January 31st, 1925. (Cognate application 15,688/25.) (249,966.)

4,102. "Loud speakers." E. Forster." February 13th, 1925. (249,979.)

4,882. "Electrical heating installations." Vickers, Ltd., and J. Etchells. February 21st, 1925. (249,983.)

7,430. "Electrically-actuated controlling apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch & Signal Co.). March 19th, 1925. (250,000.)

7,406. "Variable electric time-switch." G. Cotterell. March 19th, 1925. (250,001.)

7,652. "Electrode connections for electric furnaces." M. McGee. March 21st, 1925. (250,002.)

7,933. "Device for indicating sparking and other disturbances in, and for automatically cutting out, transformers, choke coils, and other electrical apparatus operating in an insulating medium." M. Buchholz. March 24th, 1925. (Addition to 198,936.) (250,004.)

8,266. "Electrical junction boxes and the like." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. March 27th, 1925. (250,007.)

8,463. "Brush-holders for electric machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. March 30th, 1925. (250,010.)

9,550. "Thermionic generators, amplifiers, and the like." K. E. Edgeworth. April 9th, 1925. (250,022.)

9,814. "Sound-receiving apparatus." Submarine Signal Corporation. November 15th, 1924. (242,940.)

11,632. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. May 5th, 1925. (250,037.)

12,485. "Means for testing electrical insulating materials." Dubilier Condenser Co., Ltd. (in voluntary liquidation). May 17th, 1924. (234,112.)

14,126. "Adjustable grid leaks." W. P. Fraser. May 29th, 1925. (250,052.)

17,357. "Apparatus for removing gases from storage batteries and storage-battery rooms." J. M. Clark. July 6th, 1925. (250,070.)

20,316. "Ignition apparatus for internal-combustion engines." W. J. Stonier. August 12th, 1925. (250,088.)

20,725. "Electric motor control systems." A. H. Jackson. August 18th, 1925. (250,089.)

21,295. "Electrical frequency-multiplying systems, more especially for wireless signalling." W. Dornig. October 11th, 1924. (241,167.)

21,630. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. October 3rd, 1924. (240,805.)

21,902. "Electrical condensers." Dubilier Condenser Co., Ltd. (in voluntary liquidation). (W. Dubilier). September 2nd, 1925. (Addition to 235,448.) (250,099.)

22,033. "High frequency electric furnaces." Westinghouse Lamp Co. January 5th, 1925. (245,414.)

22,447. "Alternating-current electric motors." British Thomson-Houston Co., Ltd. September 8th, 1924. (239,549.)

23,643. "Electric motor controllers." British Thomson-Houston Co., Ltd. September 23rd, 1924. (240,458.)

23,774. "Radiography." Etablissements Gaiffe-Gallot et Pilon. November 18th, 1924. (243,320.)

23,836. "Electric self-starters for the engines of motor vehicles." Soc. des Appareils Magondeaux. June 30th, 1925. (249,935.)

23,867. "Electric self-starters for the engines of motor vehicles." Soc. des Appareils Magondeaux. July 30th, 1925. (Addition to 249,935.) (250,106.)

25,097. "Radiators for cooling the oil of oil-cooled electrical apparatus." Nordon Frères. October 13th, 1924. (241,205.)

25,333. "Loud speakers or ear-phones for wireless reception and other applications." Soc. Anon. des Brevets Kornfeld. January 9th, 1925. (245,727.)

28,306. "Electric heating units and methods of making same." British Thomson-Houston Co., Ltd. November 18th, 1924. (243,337.)

28,541. "High-tension cables." M. Sieverts Fabriks Aktiebolag. November 20th, 1924. (243,342.)

28,676. "High tension cables." M. Sieverts Fabriks Aktiebolag. November 20th, 1924. (243,345.)

29,821. "Rheostats." G. H. Whittingham. July 12th, 1924. (Divided application on 236,898.) (243,742.)

1926.

287. "Systems of electric distribution." British Thomson-Houston Co., Ltd. January 24th, 1925. (246,455.)

372. "Ceiling-plate for electric lamp fittings." J. Coggans. January 6th, 1926. (250,146.)

878. "Arc-welding electrodes." British Thomson-Houston Co., Ltd. January 13th, 1925. (246,140.)

1,250. "Holders for incandescent electric lamps." Israel Akt. Ges. Geb. December 16th, 1925. (250,150.)

2,577. "Electric cables." Fuller's United Electric Works, Ltd., and A. P. Welch. May 14th, 1925. (Divided application on 12,023/25.) (250,154.)